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THE Tramway & Railway World
WITH MOTOR TRAFFIC SECTION

Founded 1892. LONDON, JANUARY 16, 1919. VOL. XLV.

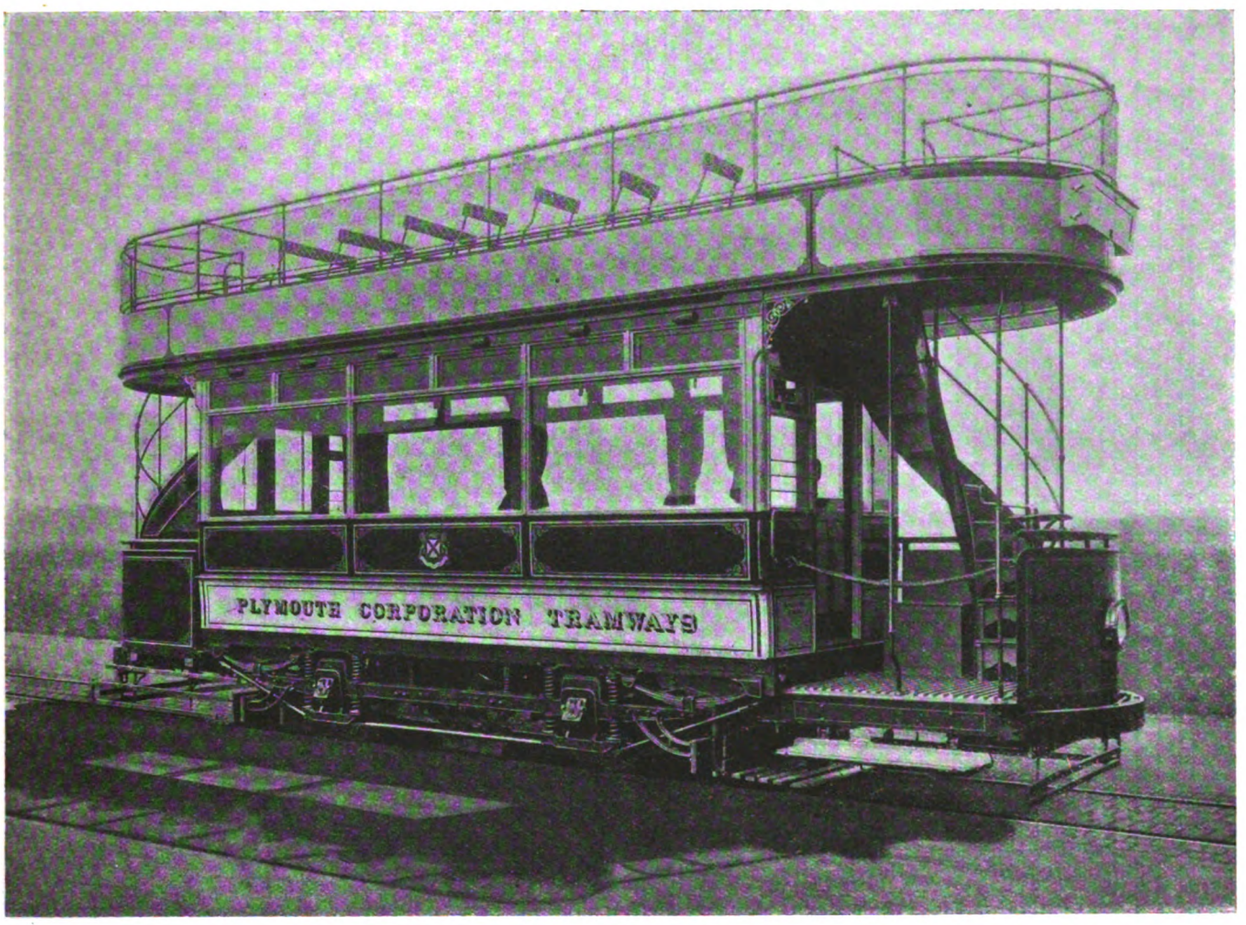
PLYMOUTH'S NEW TRAMWAY CARS.

A DESIGN ADOPTED BY THE CORPORATION AS THEIR STANDARD TYPE.

As a result of the absorption of the Devonport Tramway Company's undertaking by the Plymouth Corporation Tramways before the outbreak of the war, through running was instituted, and other means taken for increasing the traffic. The augmentation became so marked that the Corporation found it necessary to provide a considerable number of new cars, especially for the conveyance of workers to and from the dockyard.

During the four years of war the dockyard traffic has surpassed all records, and it was the certainty of this activity that enabled the Tramways department to obtain Government sanction to the provision of a number of additional cars. A full description of this type of car is appended, and it is worthy of note that the last consignment of cars is the third occasion on which this particular type has been supplied, a fact which speaks well for the satisfaction given.

The cars are of the single truck, double-decked type, and seat 54 passengers—24 inside and 30 outside.



Plymouth Corporation's Standard Car.

The general dimensions are:—

Length over body	16 ft. 8 in.
Length of each platform	5 ft. 5 in.
Length overall	28 ft. 4 in.
Length of wheelbase	7 ft. 6 in.
Width over side pillars	6 ft. 3 in.
Width overall	6 ft. 6 in.
Gauge	3 ft. 6 in.
Height inside	6 ft. 9 in.
Height, rail to trolley plank	9 ft. 11½ in.

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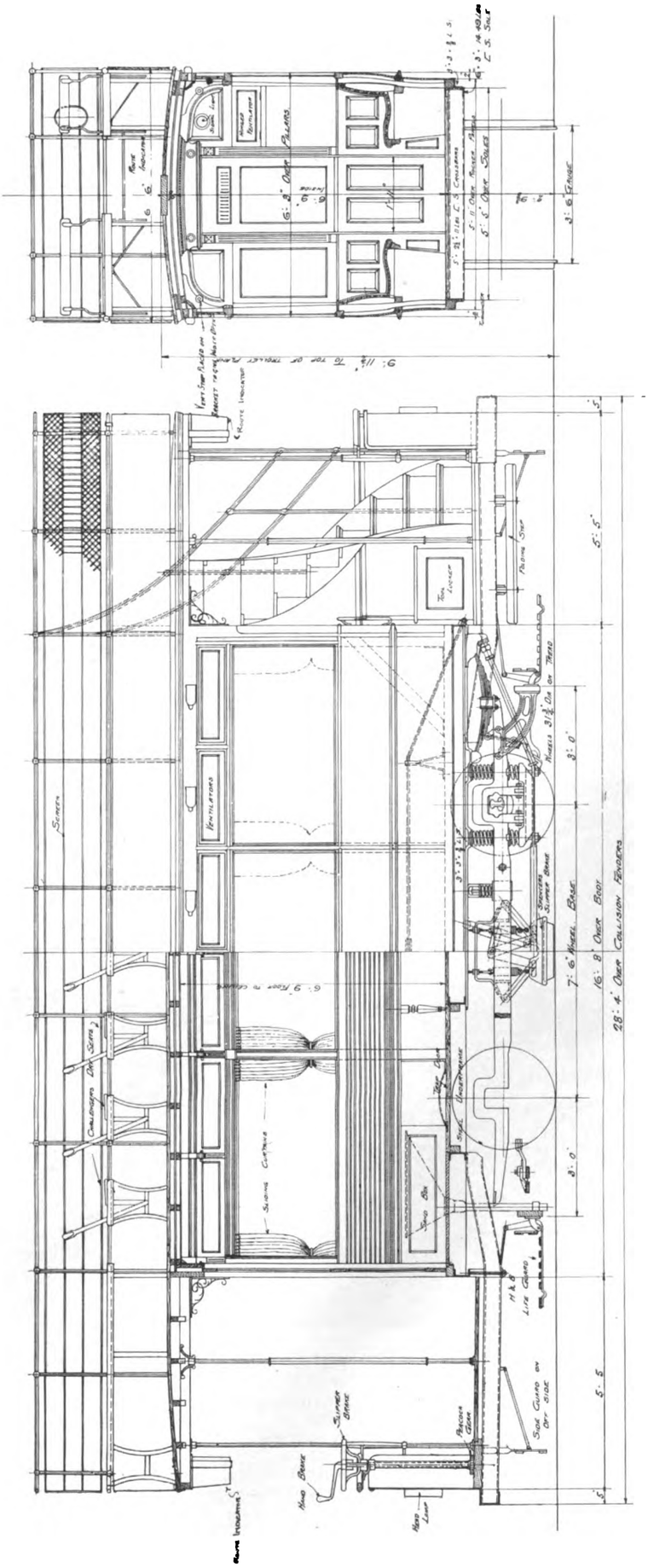

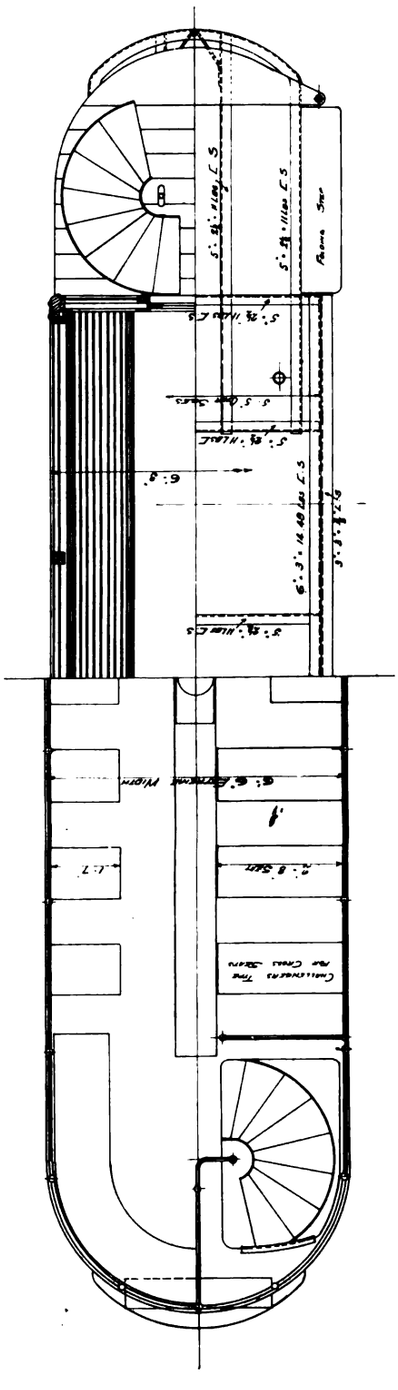

Elevation and Plan of Single Truck Top-Deck Car—Plymouth Corporation Tramways.

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The underframes are of steel rolled section strongly put together with angle knees, gussets, and rivetted; well braced and trussed in the most approved manner. The platform bearers are also of steel rolled section connected at the outer extremity to a collision fender of channel steel. Corner pillars, side and intermediate pillars, battens, and all longitudinal rails are of well-seasoned teak, the cantrails only being of pitch pine. The waist panels are of mahogany and rocker panels canary whitewood. The roof ribs of ash are strengthened by steel carlines with turned feet returned along the cantrails. The roof is of Carolina pine, covered with heavy cotton duck and rendered watertight. The upper roof is of T. and G. Baltic pine, $\frac{7}{8}$ in. thick, and furnished with wearing slats of hardwood.

The general inside finish is of oak, the seats being of lath and spaced, curved for comfort, the space below seats being unenclosed except at the ends over sand-boxes, where heel boards, with frames of oak panelled in ash, are fitted. The ceilings are of maple, veneer lined, decorated and broken up into panels by oak mouldings.

Ample ventilation is provided by means of the Brush system of pressed steel air ducts fixed along each cantrail, allowing ingress and egress of air through the perforated oak dado moulding, and also communicating with the otherwise sealed space between veneer ceiling and roof boards, thus preventing dry rot. In addition hinged ventilators are provided above the side windows, also a small ventilator in the door and a hinged casement at step side.

The windows are all of polished plate, and side windows are furnished with blinds. The usual mechanical bell communication is fitted, the cord passing through steel tubes which serve as a handpole from which leather handstraps are pendant.

Access is provided to the platforms by means of wood steps with malleable iron fittings made to hinge, the entrances being guarded by means of a chain stretched across the opening when the step is up. Protection screens and drills of ornamental galvanised netting are provided on the roof, attached to wrought-iron stanchions and surmounting rail, the latter being of brass tubing. The seats outside are of the Challenger dry seat type. Illuminated destination indicators are fitted immediately below the canopies.

Platform brakes of concentric spindle type are fitted, the ratchet handle operating the wheel brakes, the hand wheel manipulating Spencer's patent track brake. Sand gear of the Brush standard type is fitted, applying sand to both rails. Foot gongs are provided.

Lighting is furnished by three circuits of electric lamps and the usual complement of brass commode handles. All furniture is brass polished and lacquered, and up-to-date in pattern.

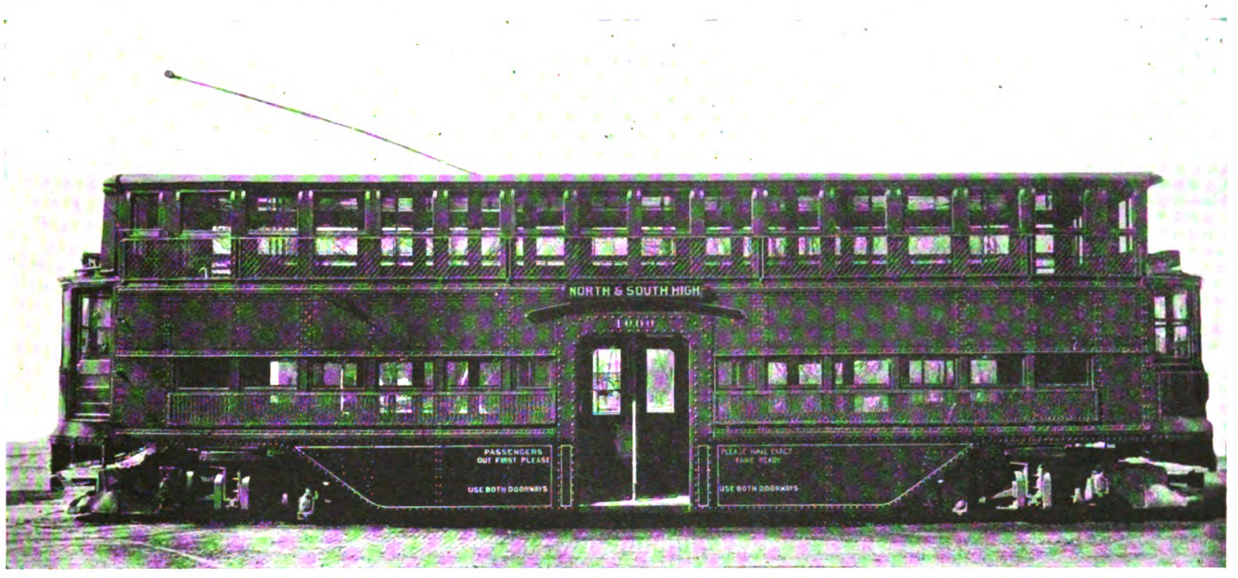
Various safety devices are provided, including Hudson Bowring lifeguards and Phillipsons' sideguards.

The truck is of the well-known Peckham pendulum P.22 type, built by the Brush Engineering Company, having a wheelbase 7 ft. 6 in., fitted with steel-tired wheels $31\frac{3}{4}$ in. diam. on tread on mild steel axles, and fitted with Spencer patent track brakes and arranged for two 221 railway motors of the British Westinghouse Electric and Manufacturing Company's manufacture. This latter company also supplied the power installation.

AMERICAN DOUBLE-DECK STREET CAR.

By R. W. A. Salter.

There are certain features about the car illustrated below which commend it to the attention of those who have anything to do with the tramways of this country. In the first place, double-deck cars are somewhat of an innovation in America—New York, Pittsburg, Washington, and Columbus (Ohio) being the only cities having them. Secondly, though following in general outline English practice, the car differs materially in arrangement and construction. Its design has evidently been carefully thought out in an effort to secure the most efficient type of cars for the required service.



A Double-Deck American Car with Low Centre Entrance.

Several cars of this type have been placed in service by the Columbus Railway, Power, and Light Company, and have fully met all expectations. The transportation situation in Columbus, it should be mentioned, presents a feature uncommon to any other large city in the United States. Out of sixteen routes worked by the company, ten diverge on to High Street, so that during the morning and evening rush hours most of the traffic is concentrated upon this one highway. Experiments were made with two-car trains; they were found too expensive to operate and, moreover, delay was caused

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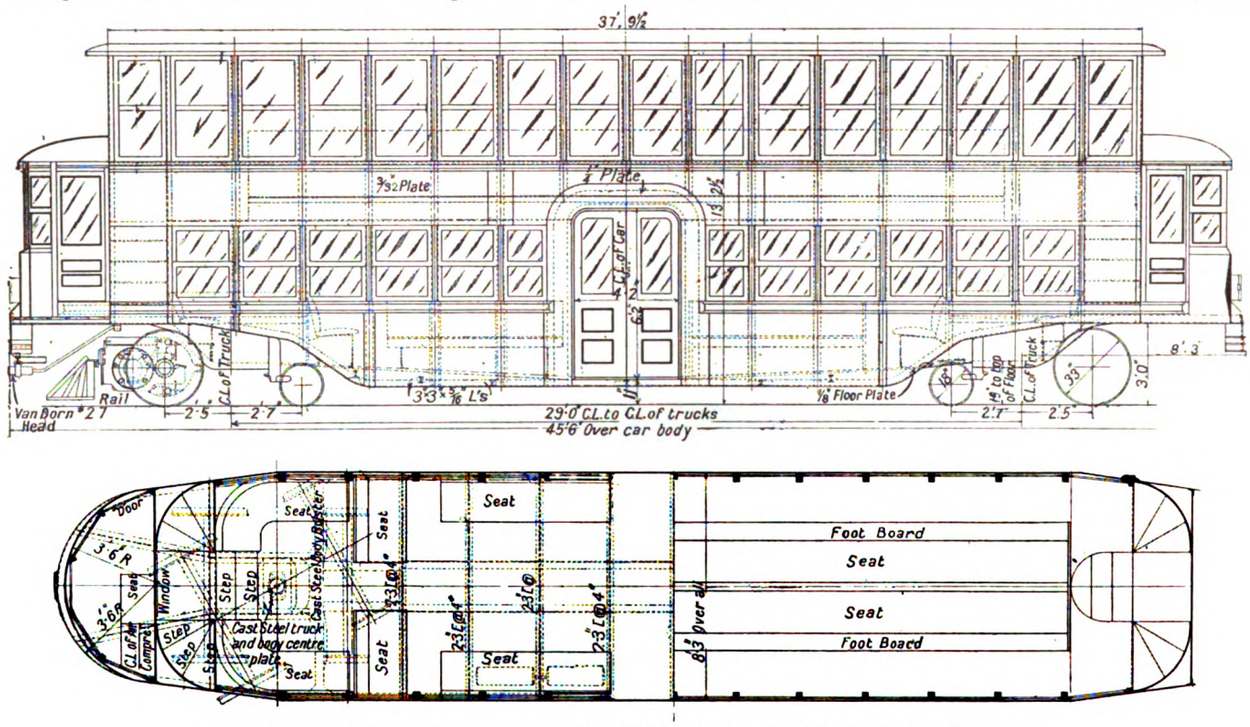
owing to the long stops. These were among the reasons which influenced the adoption of the double-deck car.

The car has a length over-all of 45 ft. 6 in., and an extreme width over the belt rails and eaves of 8 ft. 3 in. The trucks are on 29 ft. centres. The over-all height from top of rail is 13 ft. 2½ in.

Two G.E. 201-A motors are fitted. These are rated at 55 H.P. at 500 volts, or 65 H.P. at 600 volts. The equipment is designed for a schedule speed of 8½ miles per hour, but a maximum speed of 25 miles per hour is attainable. G.E. straight air-brake equipment is used.

The car fully loaded—80 passengers seated and 83 standing—weighs 69,085 lb. The seats of both decks are longitudinal, except the semi-circular seats and the two cross seats at each end of the lower deck. The seats on the upper deck are set back to back.

The car is of the low-level stepless type, the only means of entrance and exit being through the centre side doors. The entire centre of the car, for a width of 50 in., is devoted to receiving and discharging passengers. The conductor takes his position on a folding seat along the unused centre door and before him is a swinging desk. Entering passengers line up before this desk and after depositing their fares in the fare box pass on to the seats and stairways at both ends of the car. A forced-draft ventilator system is provided for both decks. The sashing and sheathings of the upper deck are removable for the summer months.



Elevation and Plan of an American Double-Deck Car with Low Centre Entrance.

NATIONAL JOINT COUNCIL FOR TRAMWAYS.

Some months ago it was expected that a National Joint Council for the tramway industry would be established without much delay. The draft constitution which had been approved by representatives of the men and the Councils of the Municipal Tramways and the Tramways and Light Railways Associations was submitted to the members of the Municipal Tramways Association at their conference in Leicester in September last. Some of the employees' local unions have, however, since raised objections to the scheme, and the London section of the Amalgamated Association of Tramway and Vehicle Workers has, we understand, definitely rejected the proposal. Unless the constitution is accepted throughout the industry it will, of course, be impossible to form a National Council as was proposed, National Joint Councils have already been formed in 47 trades.

AN AMERICAN VIEW OF BRITISH STANDARDISATION.

"The work of the British Engineering Standards Committee ought to prove, and undoubtedly has already proved," says the *Electric Railway Journal* of New York, "very valuable to the several standardisation agencies in the United States." Our contemporary continues:—"There may come a time when it will be advisable for these agencies to form some kind of an Engineering Standards Association in that country. Many of the standardisation achievements of such organisations as the Master Car Builders' Association, the American Railway Engineering Association, the American Society for Testing Materials, and the American Electric Railway Engineering Association have been very creditable, and indicate the possibilities that are ahead, but only a beginning has been made. There is much overlapping of jurisdiction on the part of the associations, and far too much exercise of individualism in design by engineers. To illustrate the latter point it is only necessary to mention the condition of electrical machinery a few years ago. Time was when each designer of a generator or motor wanted to express his individuality through it. Now all machines of this class look in general alike, and all are efficient in operation and reasonable in cost.

"An almost universal complaint that is made is that many association standards do not become real, that is, industrial standards. There must be good reason for this, and the blame cannot be placed on the industry. In many cases the standards are too academic. The purpose of the standardisations of the British Committee, as the American Association, is to secure interchangeability of parts, to cheapen manufacture, and to expedite delivery, all these desiderata being closely connected with the reduction of first costs and maintenance costs."

In conclusion, our contemporary asks if it is not time for American associations to co-operate toward standardising to these ends.

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BONDING IN RAILWAY ELECTRIFICATION.

By E. CAPONE.

The sole object of bonding is, of course, to obtain electrical continuity of the rails by joining together the separate lengths so as to form a continuous conductor either for electric signalling, supplying current to trains, or to act as a path for the return current. Bonding is done in a variety of ways, by means of plastic bonding, thermit welding, stranded strip, or solid copper with pin, solid, or expansion terminals. All these methods are employed under different conditions of work in order to make the steel rails into a serviceable conductor. A good deal of importance is attached to the efficient conductivity of the individual joints, as the sum total of resistance due to a large number of bonded joints in series may assume high proportions, and cause considerable loss. The fish-plates give sufficient contact for operating bell circuits, but cannot be relied on as conductors for even a small current, therefore each length of rail may be considered as a separate and isolated piece of metal which it is desirable to join to the adjacent lengths so as to form a chain. In cases where track rails are used for the return circuit either on tramways or railways, where conductor bars or third rails are used as a means of supplying current, it is a matter of vital importance that the connecting up of the conductor rail lengths should be carried out as efficiently as possible. It is seldom possible, owing to cost and the mechanical difficulties of making a joint, to employ bonds whose cross sectional area is equal to that of the rails; the usual plan is to use bonds having from quarter to half the conductivity of the rail. Only in a few special cases does one find bonds of equal conductivity. With track rails on single or double lines there are two, four, or more paths for the return current, which reduces the area of the bonds, but with a single return or supply rail, or two lengths of light rail as in a conduit system, it is a somewhat different matter, as the area offered is only half or less, and the bonding in such cases usually has to be of a heavier nature to reduce as much as possible the resistance at joints. With track as return the rails are crossbonded, so that all the rails act in parallel, presenting a large area for the return current. Similarly in the case of supply conductor rails on two or more tracks it is usual to arrange section switches so that the conductor rails are used in parallel under normal service conditions, thus efficiently employing the combined areas. However, there are always twice the number of rails for the return current as for the supply, so the bonding of the conductor rail must still claim first place. There are certain Board of Trade regulations restricting the permissible drop in volts and density of current in return rails which must not be exceeded. The conditions imposed are intended to limit the liability of damage due to electrolytic action; this matter, although necessarily associated with track bonding, is more concerned with the location of points of return. Negative boosters are sometimes employed to relieve the drop at certain points, but this is outside the subject of bonding. Should a breakdown occur necessitating single line working on a portion of the line, all the current from adjacent tracks would have to be carried by one conductor rail. From this contingency one can appreciate the part played by the individual bond. A series of 150 or more go to a mile of rail, and one faulty joint would counteract the efficiency of the whole length; in the words of the proverb, the strength of a chain is in its weakest link.

Reviewing work recently done is at this moment of greatest interest, as the methods employed are the outcome of practical experience, and we now have the advantage of being able to continue on the lines lately adopted on electrified railways at home and abroad. Fig. 1 shows a bond with a steel centre which was adopted on one of our sytsems some years ago, and it may help to show the object aimed at when bonding. The core, which is in the form of a barrel with splayed ends, is cast in the centre of the copper terminal. The splayed ends are of hard steel projecting outside the faces of the terminal, and the centre portion of the steel core or barrel is of soft steel. The illustration shows the terminal in place ready for bonding, and also when bonded, and it will be observed that after the press has forced in the two projecting ends of the core it has also compressed the soft centre portion or barrel. This compression does not affect the hard ends, but compels the centre to take up a different shape by being forced from an oblong into a round, and in doing this forces the copper into contact with the sides of the hole, and since the terminal has already been driven into the hole a tight fit, it gains absolute metallic contact, and is also pressed out at the end as shown. Turning to the recent work of bonding, the old pin bond (Fig. 2) is still used owing to the fact that it can be put in under awkward conditions and dispenses with a bond press. The illustration shows the correct shape before and after bonding. This bond makes a thoroughly sound job, and will continue to be greatly in favour. The shape of the steel pin and hole in the terminal are so adjusted that when the pin is driven home a proper radial pressure of the copper is obtained throughout the length of the terminal.

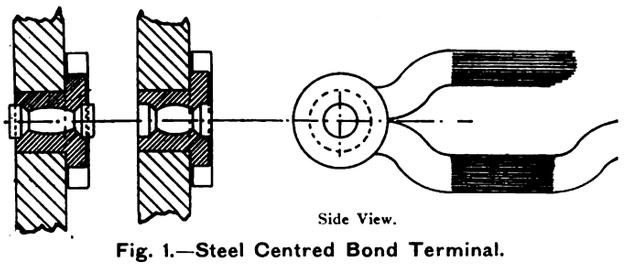

Fig. 1.—Steel Centred Bond Terminal.

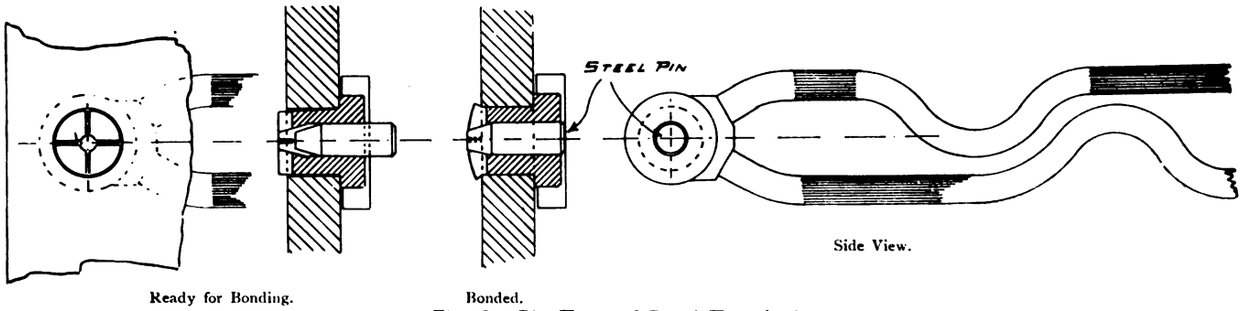

Fig. 2.—Pin Type of Bond Terminal.

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It will be noticed that where bonding is done with a pin or solid bond terminals (Figs. 3 and 4) the terminal projects $\frac{3}{16}$ inch through the hole; the object is to form a lip or rivet head which takes the part of a clamp holding the terminal rigid. It has been found that the vibration and movement at joints subject the bonds to severe strain, and this rivetting effect on a bond terminal gives valuable additional strength. Pin bonds may be viewed as a survival of the fittest, together with the use of the solid terminal type; the pin bonds can

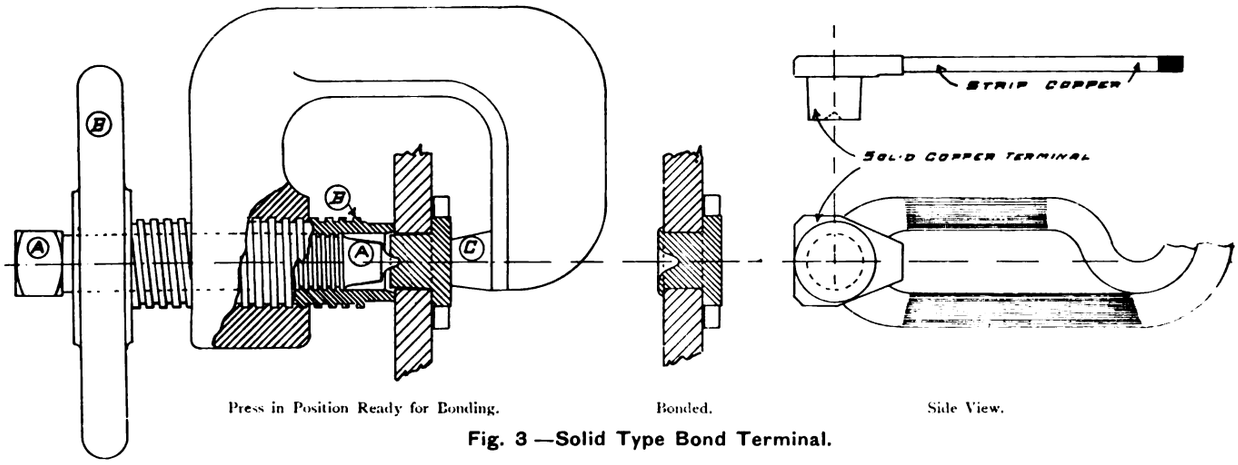

Fig. 3—Solid Type Bond Terminal.

be used on special work where one man and a hammer are best adapted to combat obstructions in a limited space. They are also used where light bonding only is required.

Solid terminal bonds can be looked upon as a standard article used at all main joints and connections where a press can be placed for compressing them. Fig. 3 shows the solid terminal bond with a hand press in position ready for bonding, and the shape of the terminal after the process is completed. Here again it will be

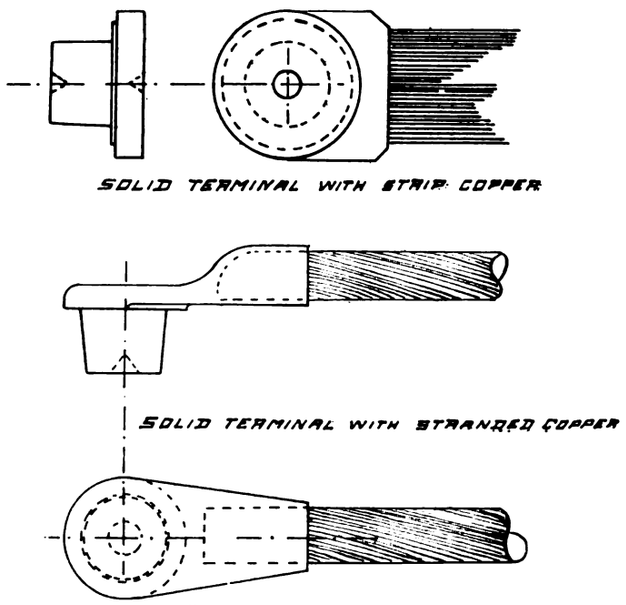

Fig. 4.—Types of Solid Terminals in Use.

seen that the point of the press acts the part of a pin by driving into the solid centre of the copper terminal, and forming a lip or rivet of the copper expelled from the centre. The press has two screws which have important functions. It is put into position so that the bond is lightly clamped between A and C, then B is screwed home hard by means of the wheel, thus forcing C against the bond terminal, and driving and holding it tightly in the hole. A, which is already in position, is then screwed into the centre of the bond by a long-handled spanner on the nut. This arrangement is necessary, as the terminal should be kept hard home in the hole whilst the point of screw A is finishing the work of forming the bond. In the old days hydraulic presses were often employed, but it can be safely stated that since hand screw presses manage the work equally as well they can be considered the most serviceable and portable tool. Something like 20 tons per square inch is obtained, and men can easily handle it with a little practice. The preparatory work of drilling and rimering holes ready for the insertion of bonds bears an important part towards the making of good joints. The holes are generally punched in the conductor rail ends at the works $\frac{1}{8}$ in. smaller than required, and the rimering to size is completed just before bonding. With track rails they are generally already laid, and have to be drilled in place, and, like the conductor rail, rimered to size just before bonding. If the holes are left for a day after having been rimered they must be thoroughly cleaned with a round emery stick before the bond is inserted. Holes that cannot be immediately bonded are often corked to prevent rust forming. It has been found, especially in warm, humid atmospheres, that rust will show itself in a few hours with some classes of soft steel rail, and any form of rust or dirt is detrimental to good metallic contact.

The holes should be a tight fit for the terminal, and the edges of the holes slightly countersunk in case they should form a ridge preventing bond heads going home; besides if all the burr is not taken off it cuts into the terminal when driven in, and causes a copper ring under the head of the bond.

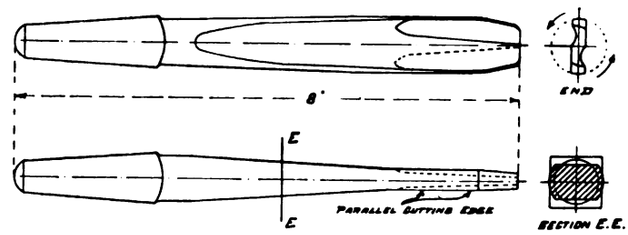

Fig. 5.—Rimer for Bond Holes.

It has been found in practice that drilling and rimering can best be done with special tools; twist drills and fluted rimers are hardly suitable for work of any magnitude, and experienced drillers pronounce in favour of the common boiler-makers' lip drill. The drills are cheap and strong compared with twist drills; they can also be reforged and sharpened; they stand the rough usage better. The class of rimers most

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successfully employed for finishing the holes is here illustrated (Fig. 5), and if carefully made and tempered they are greatly to be preferred. These tools have been found after considerable experience to be the most serviceable.

The employment of bonds outside fishplates (Fig. 6) is now only used on work under cover, or at points

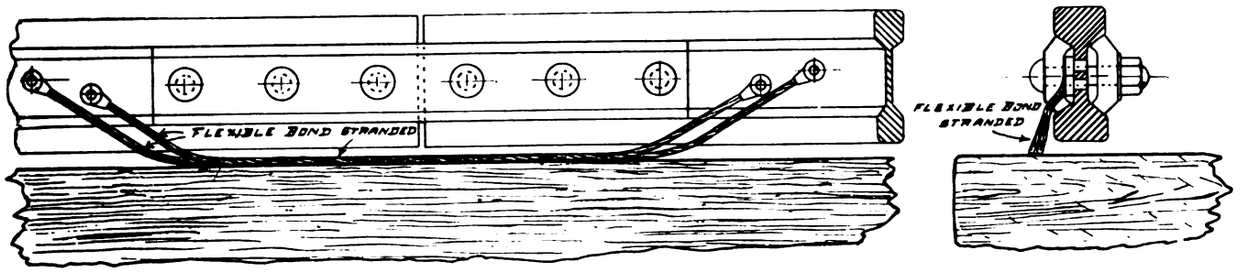

Fig. 6.—Method of Bonding Outside Fishplates.

where there are track complications. It is obviously preferable and in practice found advisable to keep bonds protected wherever possible by placing them under the fishplates (Fig. 7); with the narrow strip or ribbon bonds this is now possible under most conditions, as the bonds can be bent and formed to give sufficient elongation to take care of expansion and contraction. The formation of these parallel strips

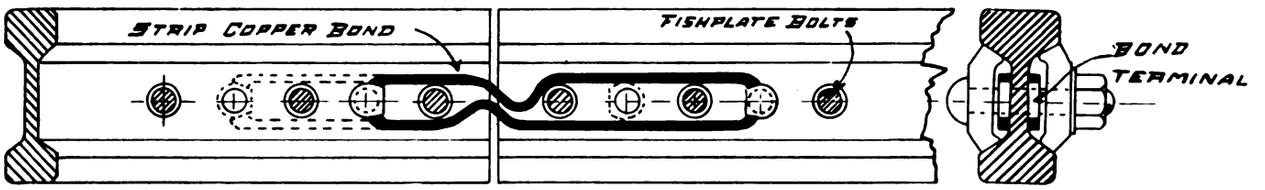

Fig. 7.—Method of Bonding Under Fishplates.

of copper gives ample flexibility for any vertical movement they may be subject to. Stranded or cable bonds can also be used under the fishplates, but being round require more room between fishplates and rail, and this space is not always available.

A few types of bond terminals are shown both for strip and stranded bonds (Fig. 4). On recent work it has been found advisable to paint bonds immediately after being fixed, using a preservative compound or hot tar. If the bonds are under the fishplates it is found necessary to pass a rod through the bolt holes in order to see that the copper strips or strands of the bonds will not foul the bolts. If this is not done the threads on the fishplate bolts are liable when being driven home to catch the bond and break some of the

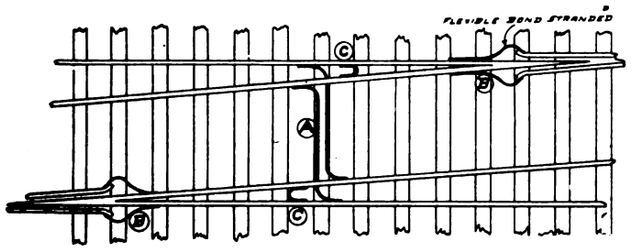

Fig. 8.—Continuity Bonding at Special Work.

strands. The bonding of rails at each joint is but part of the work; at junctions and crossovers continuity of rail must still be maintained where the rails are separated and intersected. Fig. 8 shows diagramatically how this is usually done. The outside rails of a single or double track are continuous, since the switchpoints always operate on the inside. The outside rails may be diverted at turnouts, junctions, etc., but they remain unbroken by intersection. On double lines the inside rails are broken by frogs at the crossings and junctions, and to obtain continuity crossbonding is adopted as shown on the illustration at A. The bonding shown at both C and B is not necessarily installed on an ordinary crossover or junction, but is employed at special points, where owing to electric signalling certain rails are only available for the return current, in which case all track joints at frogs and crossings have to be spanned, since the area of rail return is greatly reduced, often only half the rails being available for return. Crossbonding is looked upon as a means of equalising or distributing the return current, using all the rails in parallel, and bonds are generally installed every 120 yards, from rail to rail, but when there are separate circuits, one for signal operating with alternating current and another for continuous current, or return for the traction side, the bonding and insulation become somewhat complicated. On a recent system embodying considerable complications the whole work of bonding was laid out in full detail, both for signal and traction circuits, including the location of all impedence coils and their connections. The care bestowed on this side of the work enabled the whole section of line to be tested and started in a few hours. One of the difficulties to be contended with in the installation of bonds is the

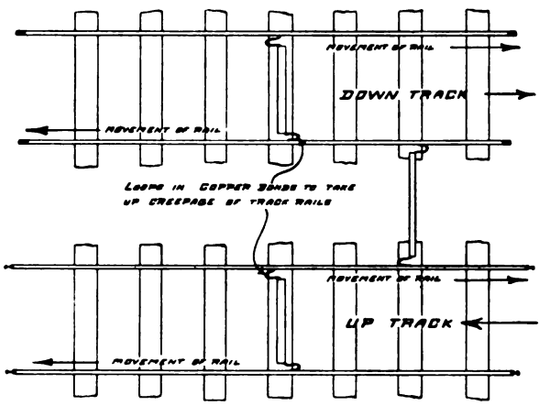

Fig. 9.—Method of Cross-Bonding to Allow for Rail Creeping.

provision for expansion and contraction; a concertina action takes place and has to be provided against, but provision has also to be made for track creepage; in this case the movement is all in one direction, lacking the redeeming feature of a return movement.

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The rail moves or creeps continuously in one direction without any direct connection with any known laws, and the rate and extent of the movement can only be known by results. This subject is open to many views, but in any case to overcome the difficulty loops or bends are allowed in the bonds, which permit the rails to move without tearing the latter away. The method found best in actual practice is shown in Fig. 9, where the direction in which the rails move on up and down tracks is indicated. The whole question of bonding involves considerable forethought; for instance, the actual process has to be carried out without hindrance to traffic, but at the same time with a minimum loss of time to workers.

Bonding has been performed under ordinary conditions of traffic by the use of a few special tools, the work being expeditiously done in the day with the constant passing of trains. It will be readily understood that trains cannot be held up on account of the fishplates being off for drilling or owing to rail expansion when they cannot be put back. To provide against the first contingency special fishplates are put on in place of the ordinary ones; these special fishplates are only used during the drilling process. These are similar to those in use on the line except that they are provided with holes opposite the place where the holes have to be drilled in the rail to take the bond. These fishplates are put on immediately the ordinary plates have been taken off, and the drillers can then set to work and stop if necessary to allow the trains to pass. Often on the ordinary fishplates being removed the rails spring apart or close up, and it becomes impossible to replace them. In this case every gang of drillers and bonders is provided with fishplates of the ordinary type, but instead of the round holes for the bolts to go through, the holes are made oblong, which allows the bolts to be put through the rail even if it has opened an inch or more. By the employment of these two types of fishplates work can be carried out without difficulty at any time.

POSITION OF ITALIAN RAILWAYS AND TRAMWAYS.

The "Societá per Azioni" has published an interview with Prof. Tiaini, president of the Federation of Transports, on the position of the Italian railways and tramways. The Professor observed that as most of the railways in Italy are run by the State, it is forgotten that many railways and tramways are worked by private industry—4,000 kilometres of railway and 5,000 kilometres of town and inter-urban tramways. These railways and tramways are of great importance; they represent a capital of about three milliards of lire, with a gross yield of about a quarter of that of the great State railway system. Dealing with the difficulties caused by the war and the inadequacy of the increases in the tariffs, which were considerable, and of other concessions, the Professor said that the State ought to take a deeper interest in the affairs of the companies. The concessions already granted are not quite clear, and require a good deal of time allowance.

Owing to the enormous increase in the price of metal materials, both railways and tramways have been obliged to slacken in the maintenance of the rails and rolling stock. The equipment generally has seriously depreciated, and the locomotives and cars run with difficulty.

Preparations should be made at once for the work of reconstitution. The day when peace is declared, the manufactories of projectiles will have no more war work, and they will have to turn promptly to the construction of locomotives and cars. The gun foundries will have to start immediately rolling rails.

Professor Tiaini advises the institution of standardisation of materials in order to effect construction in series at a rapid rate and at prices easy to quote. If after the war, he continued, they wish to provide for themselves, they must prepare immediately, for nothing can be improvised. They must build up factories for electrical materials useful for traction work. This requires a certain understanding between users and constructors, because it is not a question of preparing new lines only, but rather of the repair of existing material and the adaptation and provision of equipment that should be prepared in time. The types of material would have to be submitted for approbation to the Government.

In the years preceding the outbreak of war there was in Italy a considerable development in the construction of railways entrusted to private enterprise; this occurred thanks to legislation granting increased subsidies by the State in order to stimulate such work. It is estimated that roughly there were 6,000 kilometres of railway and as much tramway under construction when the war started. Naturally the war necessitated the suspension of this work, and made the conditions attending the concessions very onerous, so much so that some of them had to ask for a moratorium. As a measure for giving employment to the great quantity of labour that will be liberated by peace they should begin now to initiate a recommencement of this work.

LONDON OMNIBUS SUBSIDIES.

ATTITUDE OF MUNICIPAL AUTHORITIES.

At the meeting of the London County Council, on December 17, the Highways Committee presented a lengthy report on the question of the subsidies paid by the Government to the London General Omnibus Company for omnibus services, the subsidies amounting to £98,000. It was stated that the conference of municipal tramway undertakings still has under consideration questions arising in respect of the matter, and that a further report would doubtless be submitted later. The present report consisted largely of correspondence between Mr. T. B. Goodyer, who acted as secretary of the conference, and the Ministry of Munitions.

Mr. G. H. Hume, chairman of the Highways Committee, stated in reply to a question that disclosure was first made in the House of Commons that the Government were making financial grants in respect of omnibus services in the south-east of London. A deputation, representing municipal tramway enterprises, attended before Mr. Kellaway (Ministry of Munitions) and a representative of the Board of Trade, to submit the case of the municipal tramways authorities. Mr. Hume said he then pointed out that, before making grants in respect of new or increased omnibus services, they should consider whether the subsidised service was necessary in the national interest, or whether existing means of transit were adequate. After considerable correspondence, the Minister of Munitions had expressed himself satisfied that the best steps were taken to meet the situation created by war emergencies.

Dr. Scott Lidgett said they were moving towards a position in which they might claim fair play for municipal undertakings.

Mr. Squires described the subsidy as most astounding. If anyone deserved a subsidy from the Government for services in carrying workpeople during the war, it was the London County Council.

Mr. Hume subsequently remarked that the traffic of London was in a state of chaos, and he thought the attention of Parliament would have to be forced to bring the matter to a head.

East Ham Tramways Committee have received from the manager (Mr. W. C. Ullmann), a report as to the subsidy made by the Government to the London General Omnibus Company. Alderman Anstead has taken part in a conference with Mr. Kellaway, Parliamentary Secretary to the Ministry of Munitions, who has advised that a small committee of tramway managers be formed to discuss the matter with the technical officers of the Ministry. After receiving the report of these officers, Mr. Kellaway will consider what further steps can be taken.

Tramway Wages Award Effect.—The recent award to tramway employees increasing their wages to 30s. above the pre-war rate will entail heavy charges on both Corporation and company-owned tramways. It is estimated that the increase will cost the London County Council tramways department £110,000 per annum. For the Sheffield Corporation tramways the cost will be over £24,000.

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AGRICULTURAL LIGHT RAILWAYS.

SUGGESTIONS BY THE MINISTRY OF RECONSTRUCTION.

The importance of the development of light railways and of motor transport for the opening up of agricultural districts was forcibly emphasised by the Prime Minister during the recent General Election. A point still to be decided, and one on which strife will perhaps arise between advocates of different systems, is the relative spheres of light railways and of motor lorries and wagons. A wise and comprehensive examination of the subject by the promised Ministry of Transport will find suitable spheres of operation for both, so that one will be auxiliary to the other. A system of light railways would, undoubtedly, be of great benefit to the rural districts, but it need not be supposed that for some time at least there would be much return on the capital invested. It was shown in an elaborate report made to the Board of Trade by Lieut.-Col. Yorke, in 1912, that the average dividend on capital yielded by the elaborate system of light railways in Belgium was only 2·8 per cent. Some of the railways paid well and some paid nothing. This was over undertakings aggregating 3,000 miles in length. The capital was provided by the State, by the provinces, and by the communes, and the lines were leased out. Some such comprehensive scheme would appear to be necessary in this country also, if agriculture is to benefit by the means suggested. From the point of view of the electrical industry, the scheme offers considerable prospects in light and medium electric traction work.

The Ministry of Reconstruction have recently presented a detailed report to the Government on the subject of transport in rural localities. In February of last year Dr. Addison sent to the county councils and other local bodies a letter inviting their views on reconstruction questions generally. A large proportion of the replies suggested, among other things, an improvement in rural transport, and particularly in the means of inter-communication between villages and the places at present served by railways.

After a careful consideration of various methods of meeting the demand, the Department favours the development of an extensive system of light railways, which, because they will be directed primarily to the promotion of agriculture, it is proposed to call "agrails." The form of transport contemplated is neither a light railway nor a tramway in the ordinary meaning of these terms. The track would be a kind of tramway, cheaply constructed and easily laid and lifted, of 2 ft. gauge. It would be laid on the road, or, where the road was not sufficiently wide, over ditches or waste land alongside the road.

A single track would be used, with loops at frequent intervals, and fencing and signals would be reduced to a minimum. Though the gauge would be narrow, the trucks might have a considerable overlap, and, though it would be inadvisable, for the sake of the light track, to run such heavy loads, there is stated to be no reason why the trucks should not have the same capacity as standard gauge wagons. Passenger cars of some type still to be settled—possibly of the toast-rack pattern—would be run; but the primary purpose of the railways would be the carriage of agricultural supplies and produce, coal, road materials, etc. The speed would not be very high; the motor traffic limit of 20 miles an hour is suggested.

The traction would be mainly by steam or electricity, according to local conditions, and where the rails were carried into sidings on private farms, petrol tractors or horses would draw the wagons. Possibly by the use of containers, it would be feasible to run loads direct from the "agrails" to the ordinary railways with which they would be joined, while another possibility is the invention of a device whereby a wagon might serve both for road transport and for "agrail" journeys.

No great difficulty is anticipated in connection with materials or land. There is much light railway material lying in France and elsewhere, and, even assuming that the equipment in France is taken over by the French Government, the plant for making the material and the habit of making it have been fully acquired in this country. As to land, it is assumed that both in process of acquisition and in method of valuation the general principles laid down by the Committee of which Mr. Leslie Scott was chairman would be followed. As the "agrails" would be laid mainly on the roads, the land to be acquired would not be large.

The function of the Ministry of Reconstruction in this matter is advisory, and the carrying out of their plans or any others which may be accepted by the Government and authorised by Parliament would probably be entrusted to the Ministry of Transport, which the Government propose to create under Sir E. Geddes.

An experimental light railway scheme is being worked out at Biggleswade by the Board of Agriculture. Military material which was lying there is being used, and it is hoped that the experiment will demonstrate that the saving in the cost of road upkeep by the withdrawal of heavy market traffic will more than cover the interest on the local authorities' share of the capital expenditure.

NEW AND PROSPECTIVE WORK.

Doncaster Corporation are arranging for the purchase of ten new tramway cars.

Rotherham.—Rotherham Tramways Committee estimate that an expenditure of £100,000 will be necessary to double the tramway track.

East Ham Corporation will shortly require new cars, and it has been suggested that motor omnibuses should be obtained in order to relieve the tramway traffic.

Walthamstow.—Reports on railless traction are to be supplied to the members of the Walthamstow Tramways Committee, who are further to consider the subject.

Hull.—Tramway extensions are contemplated after the war has been brought to an end. The Tramways Committee have requested a sub-committee to report upon the schemes proposed.

Pontypridd.—The Council have requested the surveyor and the electrical engineer to report upon the proposed extension of the tramways at Treforest. It was decided recently that action should be taken to further the scheme.

Maidstone.—Tramway extensions at Maidstone to the length of nearly a mile and a half were anticipated in a speech by Alderman D. T. J. Lyle (chairman of the Tramways Committee), at a meeting of the Corporation. The prospective route for new tramways between Maidstone and Chatham is under consideration.

Bournemouth.—At a meeting of Bournemouth Council it was reported that an urgent request had been made to the Tramways Committee by the Government for an estimate of the quantities of rails and points and crossings likely to be required during the year 1919. The town clerk was instructed to reply that the committee did not propose to estimate for rails in 1919, but they might require 1,000 tons in 1920.

Leeds.—Mr. J. B. Hamilton, general manager of the city tramways, reported to the Tramways Committee that there were approximately 10 miles of permanent way requiring immediate renewal, for which purpose a sanction for 2,000 tons of rails had been obtained from the Board of Trade. There were at present in stock about 130 tons of rails, sufficient to make a start on a length of three-quarters of a mile, which would tax the capacities of the present staff, assisted by contractors, for a period of two months.

First Invitations for Tenders since the War.—The advertisements for tenders for tramway cars from Sheffield Corporation and for motor omnibuses from Liverpool published in our December 19 issue have occasioned much interest. *The Times* said "these are the first announcements of the kind issued by Corporations since the outbreak of war." *The Sheffield Telegraph* remarked that "there is scarcely a tramway undertaking in the country which is not in need of new cars, while hundreds of miles of track require reconstruction." *The Morning Post* observed that "the publication of these announcements in THE TRAMWAY AND RAILWAY WORLD is an indication of the early revival of business."

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Goods Traffic.

Throughout the whole history of electric traction it has been a peculiar fact that this method of locomotion has in the overwhelming majority of cases been applied to passenger traffic only and not to the transport of goods or minerals. In this country, so far as tramways are concerned, the electric tramway was the development of the horse-car system, so that it is not surprising that only in recent years have any systematic attempts been made to cultivate goods and mineral business. Among the difficulties which have stood in the way is the necessity for constructing sidings into railway yards and manufacturers' premises. As to electrified railways, the prime reason for the change was to increase the speed and carrying capacity of passenger services. Only in a very few cases in England are merchandise or minerals hauled electrically. In the United States also electric traction was primarily developed for purposes of passenger transportation. It is true that there are now some electrified railways which carry heavy mineral and freight services, but they are not numerous. The most surprising thing is that the interurban electric railways, which were built as electric lines, and are often in competition with steam lines, have done little in the way of goods and mineral services. Perhaps the reason is that many of these railways have not got their own right of way in the towns, but are really street tramways in their urban sections. Hence, like tramways in this country, they cannot readily have urban goods stations. Despite legislative obstruction there has been a good deal of agitation here in favour of developing goods haulage on tramways, and under post-war reconstruction there is a prospect of something being done. In America it appears that a similar agitation is on foot as regards the interurban electric railways. In that country there is an additional reason for the change, and one which is likely to become more marked here as our tramway systems are extended.

Motor Vehicle Competition.

This reason is the development of what are called in America motor trucks. These vehicles, if not quite the same as our motor lorries, serve the same purpose. They carry goods between town and town, set down and take up at the factories and the farms along the way, and compete with the steam railways. They can hardly be said as yet to "compete" with the interurban electric railways, because the latter have done little to try to develop a goods service. The position of the "interurbans" was discussed at a recent meeting of the Central Electric Railway Association at Indianapolis, when a paper was read by Mr. Charles J. Laney, traffic manager of the Northern Ohio Traction and Light Company. He suggested that the electric railways should put more life into their traffic departments, find out why motor truck transportation makes an appeal in their territories, and apply a consistent remedy. The railways should go after the business, and they will obtain it. Some of these trucks carry a load of as much as five tons, and they do great damage to the roads, for the maintenance of which they pay nothing, though the railways have to pay a share. It appears also that there are no laws concerning motor trucks, and the latter accept freight for return journeys at very low prices. On the other hand, the railway rates are governed by the State authorities. The contention was put forward that motor trucks should be made common carriers, and placed under the jurisdiction of the State Commission, and that they

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should be required to pay so much per ton-mile for maintenance of the highways. In all these things there are lessons for this country. We are promised a great development of inter-urban tramways and light railways, and there will be a specially rapid development of the use of motor lorries owing to the great numbers of these vehicles which will shortly become available for commercial purposes on being freed from military service. If rail-borne goods traffic on roads is to have a fair chance, conditions must be made equable. The more road traffic is carried on rails, the less the cost for highway maintenance, and that consideration alone, apart from questions of efficiency and speed, makes it necessary that the tramway and light railway should do as much of the freight business as is suitable for them.

The Wages Problem.

To tramway undertakings as well as to some other branches of industry the present wages problem presents an aspect which is peculiarly acute. In many if not most industries employees are demanding and are obtaining higher wages and shorter hours of work. The contention has been put forward on behalf of labour claims that the employers may be able to recoup themselves by the more extensive use of labour-saving machinery and by employees working at higher pressure during their shorter hours. In these ways it is claimed that production may be largely increased. One remark which may be made is that it will not be easy to get men to work more diligently and intensively if trade union customs are to be restored. The "ca' canny" principle will not easily be overthrown. But for the sake of the present argument let us suppose that it is, and that relief is found through substantially increased production. Another contention, which is applied specially to the railways, is that unification of operation and control will produce large economies. Let that also be granted. But these factors, important as they are, do not apply in the case of the traffic staffs of the tramways. Unification of working and control of the tramway undertakings of the country is obviously impossible. As to the other two remedies, increased use of machinery and more diligent labour, it may be possible to apply them in the repair shops and even to some extent in the work of track maintenance; but they cannot be brought into use so as to increase the efficiency of the traffic employees who form such a large proportion of the total. A manager cannot by the use of machinery enable a man to drive more than one car at a time. Neither can he by any ingenuity contrive that one conductor shall collect fares on several cars simultaneously. Similarly, increased diligence and energy on the part of drivers and conductors can do very little to increase the number of car-miles per car per day. The average speeds, limited in part by the Board of Trade and partly by the street traffic, cannot be very appreciably raised by increased desire on the part of drivers and conductors to do their very best. In short, unlike the case of a factory, production cannot be materially increased. The only remedy apparently is to come down once more on that general beast of burden, the British public, and raise the fares. A good deal has already been done in the way of increasing fares, and with satisfactory results. But a point must be reached where a further increase of fares will not produce an increase but a decrease of gross revenue. If not before then, certainly then, the limit of increased wages and reduced hours will be reached.

Traffic and Development Board.

It is gratifying to learn that there is a prospect of a successful issue to the persistent advocacy in these pages of the establishment of a Traffic Board for Greater London. Time after time we have emphasised the importance of this matter since the recommendation of the Royal Commission on London Traffic to the Government of 1905. The difficulties entailed by the war made the existence of such an authority still more desirable, and the case was strengthened by the Reconstruction Reports issued last year on such matters as the electricity supply of the country and the obstacles to the development of electric traction. Add to these levers the pressing matter of housing—upon which the County Council of London alone proposes an outlay of over two millions sterling—and the case for action becomes irresistible. Without adequate means of transit a housing programme becomes impossible of achievement, for Greater London has overflowed into large areas

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of surrounding counties. We pointed out in our issue of November 14, 1918, in reference to the action of the Housing Committee, in presenting a report upon housing and traction without the aid of the general manager of their tramways, that the result of their deliberations served simply to show the need of the problem being given more comprehensive and expert treatment. That view of the subject has evidently influenced Government authorities, to wit, the Minister of Reconstruction and others, through whom the Prime Minister must perforce act if he intends to have carried into effect his great policy of meeting the housing deficiencies of the past half-dozen years. For that purpose the Traffic Board idea has been extended into a Traffic and Development Board for London and the Home Counties. Such action should lift the Traffic Board idea out of the limited sphere of County Council control, which has been one of the obstacles that has hitherto prevented Government action. It is true that the party in power on the Council during the past six years have had a wider conception of the matter than the party that held the reins for so many years up to 1913, and that they have more than once urged the Government prior to the war to take action. But even their broader-minded scheme did not allow for the predominant parts that housing and the provision of arterial roads must play in any scheme for setting up a traffic authority. However, both parties now recognise the immensity of the problem. This was shown by the report of an interview which Mr. G. H. Hume (leader of the Moderate majority of the Council and chairman of the Highways Committee) recently gave to the *Morning Post* on the subject of a larger administrative area. For the want of that area negotiations on the electricity supply came to naught. By great tact the Local Government Board managed to get the multitude of authorities to come to an agreement on the question of arterial roads, but the housing problem presents obstacles that have the appearance of being insurmountable. No surprise need therefore be felt at the announcement that a Committee is sitting to draft a Bill for a Traffic and Development Board for an area extending far into the Home Counties. All parties may be congratulated upon the circumstance that the chairman is Mr. Rees Jeffreys, who is completely detached from any influence, and has shown organising ability, first as secretary of a national motoring body, and since 1911 as the first secretary of the Road Board, from which he has now retired.

DEATH OF MR. STEPHEN SELLON.

We deeply regret to record the death of Mr. Stephen Sellon, M.Inst.C.E., which occurred suddenly on December 21 while he was travelling to London from Edinburgh. In Mr. Sellon's death the tramway world suffers a loss that will long be felt. He was a pioneer of electric traction, and for the past twenty-five years and more he had done valiant service in the development of tramway and light railway facilities in this country. In these days it is difficult to realise the strength of prejudice and the force of the inertia which the early pioneers had to overcome in introducing electric traction. Mr. Sellon in a few years became the best known expert witness in tramway Bill investigations by Committees of the Houses of Parliament and at light railway inquiries by the Light Railway Commissioners. The last Parliamentary Bill in which he appeared related to the Sheffield Corporation's application last session for powers to carry goods on the tramways.

In early life Mr. Sellon gained railway engineering experience, and later was engaged on the construction of the Barry Railway and the Manchester Ship Canal, but from 1893 he devoted his attention almost wholly to electric tramways and light railways, varied by work on several Irish relief railways for the Irish Light Railway Commission, and by the construction of the Wolverton and Stony Stratford Light Railway, and the Newport Pagnell Tramways. Mr. Sellon was responsible for the introduction of electric traction in Leeds, where he was given a concession to electrify the Roundhay line, the work being carried out by the British Thomson-Houston Company. This line, on which service was begun in November, 1891, not only proved successful, but it also served the useful purpose of a demonstration to local authorities and others of the advantages of electric traction. After service on the Board of Trade Committee, which framed the Light Railways Act of 1896, Mr. Sellon was responsible for the equipment of numerous electric tramways carried out by the British Electric Traction Company. At various times he also acted as consulting engineer to a number of tramway companies and municipal authorities, including the Bristol Tramways Company, the London United Tramways, the Metropolitan Electric Tramways, the North Metropolitan Electric Power Supply Company, the South Metropolitan Electric Tramways and Lighting Company, etc. He prepared all the traffic estimates for the London Tube Railways. He was an active member of the Tramways and Light Railways Association, and of late years he had devoted great attention to forwarding the case for reform in tramway and light railway legislation, and he gave evidence before the Committee on Electrical Industries whose important report was issued last year. He performed most valuable work as a member of the Board of Trade (Tramways) Committee, upon which his geniality conduced greatly to the despatch of the arduous work upon which the Committee was engaged.

At the meeting of the Executive Council of the Tramways and Light Railways Association, on January 6, Mr. Howley, in the unavoidable absence of Sir Arthur Stanley, moved a resolution expressing the sympathy of the Association with the relatives of Mr. Stephen Sellon, who was one of the founders of the Association and a prominent and valued member. He had been a vice-president of the Association for many years, and at the special request of the Council regularly attended their meetings. Mr. T. B. Goodyer seconded the resolution, which was agreed to by the members silently upstanding.

MUNICIPAL TRAMWAYS ASSOCIATION.

Appointment of Honorary Secretary.

Mr. G. W. Holford, general manager of Salford Corporation Tramways, has, with the consent of the Salford Tramways Committee, accepted the appointment of honorary secretary of the Municipal Tramways Association, in succession to Mr. W. Clough, whose resignation was recently announced. Mr. Holford is well known in the tramway industry. He has been general manager of the Salford Tramways since 1902 and has been a member of the Executive Council of the Municipal Tramways Association for many years. He has also acted as honorary secretary of the Lancashire and Cheshire Tramways Managers' Association for the last eight years.

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N.E. COAST LOCAL AUTHORITIES AND ELECTRIC POWER SUPPLY.

The recent reports by the Government's Coal Conservation Committee and the Electric Power Supply Committee have stirred up the local authorities on the north-east coast of England to put forward strong statements of their views. The Corporation of Newcastle have adopted a report by their Parliamentary Committee, and the north-east coast local authorities jointly have issued a statement and sought for an interview with the President of the Board of Trade and the Minister of Reconstruction on the subject.

The Newcastle Parliamentary Committee in their report say :—

The Committee are apprehensive that, if the proposals of these reports receive legislative sanction, the monopolies of the private electricity companies in this district will be maintained and consolidated, and that the publicly-owned undertakings which generate and supply electricity in bulk in Newcastle-upon-Tyne and in other parts of the north-east area of England may pass from the ownership and control of the municipalities who at present own them, and be wholly dominated by a company or aggregation of companies conducted for private profit, enjoying (possibly with financial assistance from the Government) a monopoly of electrical enterprise in this area ; while at best municipal electricity undertakers will be reduced to the position of distributors in their own areas of electricity supplied to them in bulk by the companies.

The Committee are of opinion that it would be contrary to public policy that a public utility service of this character which is a monopoly should be under the control of private companies, the tendency during recent years having increasingly been to place such services under the management or direction of local representative bodies ; and in view of the circumstance that the Corporation have a right of acquisition within six months of July 3, 1922, of the electric lighting undertakings in the city of the Newcastle-upon-Tyne Electric Supply Company and of the Newcastle and District Electric Lighting Company, and are themselves already generators and suppliers of electricity for purposes of traction and power, the matter is regarded as one of extreme importance in the interests of the city.

The town clerk has prepared a statement which has been settled in consultation with representatives of other local authorities in the north-east area who are owners of electricity undertakings.

It is proposed that this statement, when approved by the other authorities, shall at an early date be formally presented on behalf of the municipalities to the President of the Board of Trade (Sir Albert Stanley) and to the Minister of Reconstruction (Dr. Addison).

The statement referred to in the above report has been prepared on behalf of the following local authorities :—Berwick-on-Tweed Sanitary Authority, Middlesbrough, Newcastle, South Shields, Stockton, Tynemouth, and West Hartlepool. Sunderland and Darlington were not parties to the statement, and it was stated that their view was that they would be able to claim exemption from any scheme of unification. In the course of the statement it is said :—

The reports of the Government's Committees invite the recognition by Parliament of proposals so wholly at variance with the ordinary practice respecting public utility services, and so subversive of the necessary local public control of electricity supply, that the municipalities have deemed it desirable to formulate their main grounds of objection.

The municipalities concede that the unification of the production and distribution of electrical energy for areas sufficiently large but carefully defined is desirable, provided that the best use is made of existing systems of generation and distribution, that the generation and distribution of electrical energy is under local public control, and that proper and reasonable safeguards are adopted in the interests of existing undertakers and consumers, and in particular that those municipal undertakings which can, in the opinion of the Electricity Commissioners, be economically worked without interfering with the efficiency of any general scheme, should continue to be owned and operated by their present owners.

Limitations of areas of supply have in the north-east coast area operated to restrict expansion and to limit economy of production in regard to municipal electrical undertakings, to an extent markedly greater than has been the case with respect to private supply companies, and in so far as the reports affirm the desirability of widely extended areas of supply, the municipalities are in agreement with the recommendations of the reports.

With respect, however, to the Coal Conservation Sub-Committee's report, the municipalities cannot ignore the fact that a report purporting to deal with problems of national economy in coal consumption has been utilised as a vehicle of attack upon the policy of municipal control of electricity undertakings, and has been made the means of promulgating proposals which, if carried into effect, may be expected, in the north-east coast area, to consolidate the position of the Newcastle-upon-Tyne Electric Supply Company and its allied and subsidiary companies, and to involve the subordination of municipal electrical undertakings to the dominance and control of the north-east coast group of power companies.

The report of the Coal Conservation Sub-Committee is accepted by, and has clearly influenced the Electric Power Supply Committee in arriving at their conclusions. The report cannot, however, be regarded as presenting any elements of finality, nor as offering other than the expression of the individual opinions of its framers.

Its conclusions are sought to be supported mainly (i.) by an estimated coal saving of 55 million tons per annum, and (ii.) by a comparison between the average charge for electricity in the north-east coast area and the charges of a number of municipalities in the southern parts of Lancashire. The municipalities challenge the statement that a coal saving such as is estimated will be effected, and they are prepared to give in detail the grounds upon which they dispute the accuracy of this estimate.

The adverse comparison sought to be drawn by the Coal Conservation Sub-Committee between the alleged "average charge of less than ½d. per unit" of the north-east coast supply companies and the charges of the Lancashire municipalities, is misleading and mischievous. No details are vouchsafed showing how this alleged average charge is arrived at, and the municipalities deny that it is in any sense a true and accurate representation of the facts. On the contrary, the municipalities assert that where all material factors are taken into consideration, the charges of the north-east coast supply companies will be found to approximate very closely to those of comparable municipal undertakings.

Even should the allegation of an *average* charge of less than ½d. per unit be justified, the comparison is none the less misleading and fallacious, because the statement in Table V. of the Coal Conservation Sub-committee's report, purporting to give the average prices charged for power by the Lancashire municipalities, gives prices which include the cost of distribution and other incidental expenses, and relate very largely to low tension units supplied to consumers on their own premises, whereas a large proportion of the units supplied by the north-east coast supply companies are high-tension units supplied in bulk to the distributors and users of electrical energy who, generally speaking, have to add the cost of transformation, and in some cases that of distribution, together with their profit, in the price actually charged to the ultimate consumer.

As regards the proposals of the reports respecting the constitution and powers of the proposed Board of Electricity Commissioners, the municipalities recognise the desirability of the establishment of some central and impartial authority charged with the duty of fostering electrical enterprise and encouraging the use of electricity as a source of motive power in industrial concerns.

The municipalities, however, view with grave concern as a dangerous extension of the policy of bureaucratic control the proposal to confer powers which for all practical purposes will determine the development of electrical enterprise throughout the country upon a small body of permanent officials, who will be supreme over all existing and future electricity undertakings, appointed by the President of the Board of Trade without reference to any superior authority, three of whom will hold office subject only to an age limit, and two of whom will be appointed for a short term of years.

A small body of technical experts, however eminent individually, is in the view of the municipalities unfitted to be entrusted with autocratic powers of the character proposed, and the central electrical authority should be so constituted as to be directly susceptible to the influence of public opinion, and should comprise a sufficiency of members of independent judgment and general experience.

It is essential that any such central electrical authority should be free from partisan bias.

The first Board of Electricity Commissioners should, it is submitted, either be appointed directly by Parliament, or be constituted in accordance with directions given by Parliament so as to secure an impartial and judicial body.

With respect to the delimitation of electrical districts and the constitution of District Boards, all the facts are ascertainable immediately, and these questions it is submitted should be disposed of by direct Parliamentary action after preliminary local inquiries.

It is unreasonable that any embargo should be placed upon extensions of existing electrical undertakings during any interval which may occur before the suggested super-power stations are in a position to supply power, especially as the commercial necessities of the situation may demand an immediate increase in the supply of electric power, which, the municipalities submit, can be effected quickly and economically by enlargements and extensions of the plant of existing undertakings.

The municipalities have already commented upon the pronounced anti-municipal bias of the Coal Conservation Sub-Committee's report. This bias, while not so directly expressed in the report of the Electric Power Supply Committee, is none the less present therein, and the municipalities fear that if its proposals are put into effect the result in the north-east coast area will be that the generation and supply in bulk of electricity may well pass from the municipalities, and that the north-east coast group of companies will be left to continue their operations either on their own account or as lessees from the District Board.

The municipalities further direct attention to the inequitable character, so far as regards municipal electrical enterprises, of the financial proposals of the report. It is apparently proposed that the generating stations and distribution systems of municipalities shall be taken over by the District Electricity Boards, on terms

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which imply no more than the bare discharge of outstanding loans by means of terminable annuities.

The basis of compensation proposed by the report will act unfairly as between municipalities and companies, and will have the effect of penalising those undertakers who have set up adequate reserve funds and maintained their undertakings in an efficient manner, and of favouring those undertakings which have distributed an undue proportion of their surplus revenues amongst shareholders, or in reduction of rates.

It is submitted that if Electricity Boards are to be constituted to take over existing electrical undertakings, the terms of transfer of municipally and commercially owned generating stations and distributing systems should proceed upon the same basis, and that whatever terms are given to the one should be given to the other.

Again, the municipalities object to the recommendation of the Electric Power Supply Committee's report that whereas commercial distributors are to continue to exercise the right of paying dividends subject only to the limitations of a sliding scale of charges to consumers, municipalities who continue to distribute electricity are to be permitted either to make no profit at all or only a nominal profit.

Furthermore, the municipalities take strong exception to the proposal that District Electricity Boards or their lessees should be empowered to supply high-tension electricity in the areas of municipal distributors of electricity, and it is contended that, with the possible exception of electricity used by railway companies for traction purposes, there should be for each local area of supply a single distributor of electricity regardless of the question whether the energy supplied is low-tension or high-tension electricity.

Finally, it is manifestly inequitable that power supply companies should, to the exclusion of municipalities, have conferred upon them, as is proposed by the Electric Power Supply Committee's report, the right of supplying electricity for lighting purposes in places where there is at the time no lighting supply.

The municipalities do not concur in the proposals of the Electric Power Supply Committee's report that a preferential basis of rating should be accorded to electricity transmission mains, and that the existing restrictions as to the use of overhead lines should be removed. With respect to the former, the municipalities, not only as owners of electrical undertakings, but in respect of their tramways, main sewers, and other assets, have borne in the past their proportion of local rates, and they see no reason why differential treatment should be extended to electricity transmission mains to the exclusion of other analogous rateable hereditaments. As regards the latter, while in rural areas, and as a temporary expedient, the use of overhead lines for the transmission of electrical energy may be, in special circumstances, desirable and even necessary, a general concession of this character in urban areas is to be deprecated.

The municipalities observe with satisfaction that the Electric Power Supply Committee's report recommends that in the national interest generating stations and main transmission lines ought, as a general rule, to be publicly owned, and they submit that the District Electricity Boards should in all cases be so constituted as to be wholly independent of the influence or control of commercially-owned electrical enterprises. To secure this object it is strongly urged that the District Electricity Boards should consist of representatives of local authorities and large consumers, to the exclusion of companies generating electricity.

In conclusion, the municipalities view with the gravest misgivings the manifest dangers presented by the recommendations of the reports of the establishment in the north-east coast area of an electrical "trust" exercising with Parliamentary sanction paramount powers in that area with respect to the production and supply in bulk of electricity. They therefore most earnestly request that before any proposals are submitted to Parliament, based upon the reports, His Majesty's Government will institute a complete and exhaustive inquiry, by some competent and independent authority, in order that accurate data may be forthcoming as to the statements and findings contained in the reports, and that no affirmative action be taken until an adequate opportunity has been afforded to the municipalities of presenting their views before an unbiassed and impartial Committee of Parliament.

ELECTRICITY NOW AND AFTER THE WAR.

Views of the Tramways and Light Railways Association.

Important correspondence has passed between the Institution of Electrical Engineers and the Tramways and Light Railways Association in regard to the reports of the Board of Trade Committees on (*a*) electric power supply and (*b*) electrical trades after the war.

The secretary of the Institution (Mr. P. F. Rowell) writes:—

"A meeting of the committee appointed by the Institution to report on the above was held at the Institution Offices on Monday, July 29, at which there were present representatives of the Institution of Electrical Engineers, the Incorporated Association of Electric Power Companies, the Provincial Electric Supply Committee of the United Kingdom, the Municipal Tramways Association, the British Electrical Federation, Edmundson's Electricity Corporation, the British Electrical and Allied Manufacturers' Association, the Cable Makers' Association.

"After discussion the meeting was unanimously of opinion that in view of the fact that interested associations are at the present moment considering the above reports and preparing their comments thereon for submission to the Board of Trade, it would be extremely desirable, in order to avoid overlapping and to secure unanimity as far as obtainable, to ask each association to defer sending their comments to the Board of Trade at this stage, but to send such comments to the Institution Committee.

"It is proposed that all comments that may be received by the committee in this way shall be analysed and compared with a view to bringing them into line as far as possible, the intention being that eventually after such further consultation with the various associations as may be necessary one single representation, consisting of two sections, shall be made by the Institution to the Board of Trade. The first section would consist of unanimous recommendations, and the second section would consist of recommendations made by one or more associations, in which case it would be clearly indicated which associations support the respective recommendation.

"The committee feel strongly that a single representation of the kind indicated, made by the Institution after consultation with the various associations represented, would carry far greater weight with the Government than a number of recommendations from individual associations made without any attempt at co-ordination and in the nature of things inevitably at complete variance with each other.

"Should your association agree to the request of the committee I should be glad to receive their comments at the earliest possible date, as the committee feel that it is extremely desirable that the representations from the Institution to the Board of Trade should be made while the Bill is in progress of being drafted, rather than put in after the Bill has been drafted.

"In order to facilitate the co-ordination of the various comments received it is suggested that as far as possible the comments of each association should be sub-divided under the following headings:—(*a*) Technical, (*b*) financial, (*c*) personal, (*d*) users."

In reply, the secretary of the association (Mr. A. de Turckheim) writes:—

"I am instructed by the Council of the Tramways and Light Railways Association to transmit for the information of your committee their observations on the recently issued reports of the Electric Power Supply Committee and the Electrical Trades Committee appointed by the Board of Trade. In forwarding these observations I am desired to point out that they should be regarded as a first contribution to the deliberations of your committee and not as the finally considered decision of this association on the many important matters dealt with in the two reports.

"1. Electrical energy is the motive power used, with very few exceptions, by all tramways and light railways in the United Kingdom. According to the last Board of Trade Return (1913-14) the annual consumption amounted to 629,862,019 B.T. units. Allowing for additional services and increased loading since that date, it may be estimated that the number of units used last year by tramways and light railways amounted to some 750 millions. According to Garcke's Manual the total number of units sold last year for all purposes amounted to 2,366 millions. Tramways and light railways therefore utilised last year nearly one third of the total quantity of electrical energy produced in this country.

"2. A number of tramway and light railway undertakings derive their supply of energy from their own stations, providing only for the traction supply, but by far the greater number of undertakers purchase the energy they require or supply themselves from a general supply station which they own and operate.

"3. The Council believe that tramways and light railways undertakers owning purely traction stations fully appreciate the economic and other advantages of the combination of all classes of electricity supply, and would be willing to dispose of their stations subject to receiving adequate compensation for the expenditure they have incurred both on the stations and the main feeders and to receiving an undertaking that they will be supplied with electricity at least as cheaply from another source. The terms of purchase recommended in the report of the Committee on Electric Power Supply cannot be equitably applied to tramway power stations. The addition of a tramway load to a general supply has a beneficial effect on the cost of production of the latter, and this should be taken into consideration in the event of a sale.

"4. The Departmental Committee on Electrical Trades deal in Clauses 34 and 35 with some of the more important disabilities under which electric tramways suffer, namely, recurring periods of purchase, the incidence of the burden of road repairs, periodic revision of fares, settlement of rating questions and running powers. The Committee expressed the view that unless there be a complete revision of the present powers the development and growth of tramways and light railways will continue to be impeded. The Council fully endorse this view, and strongly urge that the revision

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of the Tramways Act, 1870, and the Light Railways Acts should be one of the first matters pressed on the attention of the Government.

" 5. Both Committees in their reports refer to the bad effect of compulsory purchase, especially when the power to purchase may be exercised at short recurring intervals. The Tramways Act, 1870, unfortunately created a precedent in regard to terms of purchase, which have since become notorious under the name of 'tramway terms,' and have been made applicable, with some modifications, to Electricity Supply Acts and Orders. Tramway terms of purchase tend, as the date of purchase approaches, to retard the development of any business to which they apply. Parliament has perpetuated this, the worst feature of these terms of purchase, by permitting after the first long period has elapsed, the exercise of the same condition of purchase at short recurring intervals, thus putting a stop to the development and improvement of the undertaking which are essential to efficiency. The revision of tramway and electricity supply legislation in regard to terms, and especially to periods of purchase, is, in the opinion of my Council, imperative, not only for the well-being of the industry, but also in the interests of the public.

" 6. The Council supports the views expressed in both reports that a permanent body of Commissioners, consisting of men of ability and high standing, should be constituted, to whom all questions concerning electricity supply and electric traction should be submitted.

" 7. The Commissioners should advise the Government of the day on all matters appertaining to the electrical industry, and should be authorised to consider and enquire into all applications for new powers and the revision of existing powers. They should be placed in a position to envisage the whole field and to base their recommendations on broad national lines. To enable them to advise without being unduly bound by precedents my Council recommend that they should, in the first place, be appointed by the Minister of Reconstruction, and should report to Parliament through him. The Council are of opinion that the Commissioners should, at any rate at first, be empowered to act only in an advisory capacity.

" 8. Tramway and light railway undertakers are not so vitally affected as electricity supply undertakers by the various proposals contained in the reports for the generation and distribution of electricity by District Electricity Boards and others. A reliable and adequate supply of energy at a cheap rate is to them of the first importance, and any scheme which will ensure this end will meet with the full support of the association

FINANCIAL REPORTS AND MEETINGS.

DONCASTER CORPORATION TRAMWAYS show a surplus on the working for the last financial year of £3,838, as compared with £2,083 in the previous year.

YORKSHIRE (WEST RIDING) ELECTRIC TRAMWAYS COMPANY.—A final dividend of 3 per cent., being at the rate of 6 per cent. per annum, on the 6 per cent. cumulative preference shares is announced.

BRIGHTON TRAMWAY ESTIMATES.—The profits of the Brighton Corporation Tramways for the current financial year are estimated at less than £10,000 as compared with £15,428 last year. The profits from the electricity undertaking are also expected to show a decline.

AUCKLAND ELECTRIC TRAMWAYS COMPANY, in the report for the year ended June 30 last, states that the total revenue was £301,435. Traffic receipts amounted to £294,564, an increase of £11,867. After providing for all expenses there is a surplus on the year's working of £53,430; £5,293 was brought forward, making £58,723. The directors recommend that £10,000 be transferred to reserve account (making £152,500), and that a further dividend be paid on the ordinary shares of 1s. per share, less income tax, for the half year ended June 30, making 1s. 6d. per share for the year, and £5,973 be carried forward.

NATIONALISATION OF RAILWAYS.—Shareholders are exhibiting no alarm at the prospective nationalisation of the railways. The news should in fact be rather comforting than disquieting. It cannot be doubted that the Government will treat the owners with fairness, when the details come to be worked out. The Railway Act of 1844 gives the Government power to acquire all railways constructed after that date, but on the basis of twenty-five years' purchase of the annual divisable profits estimated on the average of the three years preceding the date of purchase. The price is to be determined by arbitration, and no doubt consideration would be given to cases where the undertaking has not yet fructified.

NEWCASTLE CORPORATION TRAMWAYS.—At a meeting of the committee under the presidency of Councillor Richard Mayne, the accounts for the year 1917-18 were submitted for consideration. The traffic receipts, together with revenue from other sources, amounted to £418,028, against £356,534 for the previous twelve months. The gross expenditure was £248,394, as compared with £208,299. The gross profit was £169,634, against £148,235; and the net profit £90,785, against £62,902. After allocating £14,000 in relief of the rates and making provision for the payment of income tax and insurances, £55,000 had been applied to the reserve and renewals fund, bringing that up to £155,251, against £105,894 for the preceding year.

LUTON TRAMWAYS.—The revenue accounts of the tramways lessees from April 1, 1913, to January 31, 1918, have been submitted to the Luton Corporation, who have requested the town clerk to inform Messrs. Balfour, Beatty and Company, Limited, the lessees, that the Council have for a long time been dissatisfied with the condition and working of the undertaking, especially (*a*) the track (which in many places is in a dangerous state); (*b*) the overhead equipment; (*c*) the cars and their mechanism; (*d*) the inefficient and unpunctual services on some routes; (*e*) the inattention of the drivers and conductors to passengers and would-be passengers. The lessees were given notice to promptly provide and maintain an efficient service, and to execute by not later than June 30, 1919, all such works, repairs, and renewals as are necessary to comply with the terms of the lease as to maintenance and repair.

PROVINCIAL TRAMWAYS COMPANY, LIMITED.—The report for the year ended September 30, 1918, signed by Mr. J. Barber Glenn, managing director and secretary, states that the net revenue received from the local companies amounted to £59,054, compared with £49,720 last year and £52,288 in 1916. After carrying to reserve and depreciation account £12,000, adding to the reserve account for third party insurance, excess profit duty, etc., the sum of £5,000, and carrying £15,000 to the reserve account for deferred repairs, there is a balance of £16,108. A dividend is to be paid on the ordinary shares of 10d. per share and a bonus of 6d., equal to 1s. 4d. per share, making, with 8d. per share paid in June last, 2s. per share, a dividend at the rate of 10 per cent. for the year ending September 30. The balance dividend and the bonus on the ordinary shares will absorb £8,304, leaving £7,804 to be carried forward. The excess profit duty for 1917 and 1918 will be adjusted during the current year.

CAPE ELECTRIC TRAMWAYS.—Mr. Ludwig Breitmeyer, presiding at the meeting of the Cape Electric Tramways recently, referred to the recovery in the traffic receipts which was steadily continuing, and was a most satisfactory feature. During the year under review the number of passengers carried on the Cape Town and Port Elizabeth systems was 25,444,465, an increase of 2,692,449. The receipts were £264,137, an increase of £33,032. Both passengers and receipts constituted a record. The working expenditure was, higher owing to the cost of labour and the prices of supplies and materials. The ratio of expenses to receipts at 61·16 was, however, very little higher than last year. The profits earned showed a surplus of £3,420. Some increases in fares had been put in force toward the end of the past financial year. There was a profit of £88,512, and after deducting interest and sinking fund on debentures, the net profit was £39,800. Including £2,591 brought forward from last year there was an available sum of £42,391. Of this amount £12,000 had been set aside to reserve. A dividend of 5 per cent. would absorb £24,561, leaving a balance of £5,830 to be carried forward.

PRESTON CORPORATION TRAMWAYS.—The report for the year ending March 31 shows a total revenue of £63,497, which, after deducting working expenses and war service allowances, £43,492, gives gross profit of £20,005, which, less chargeable items, leaves a net surplus of £4,158. This amount added to balance from previous year gives £10,069, of which £2,831 is allocated to capital outlay and £5,500 to the relief of the rates, being a balance on revenue account of £1,738. The increase in the revenue was £5,722, and the increase in passengers was from 13,809,189 to 15,455,163. There was an increase in working expenses amounting to £7,599, due principally to war bonuses and the constant advance in price of materials used for repairs. The expenses for the years 1916-17 and 1917-18 respectively were:—Traffic £15,317, £18,232; general £5,429, £7,030; repairs and maintenance £8,345, £11,063; power £5,733, £6,098. The sum of £1,066 has been paid to dependants and employees on war service. Statistics for the years 1916-17 and 1917-18 respectively include: traffic revenue £57,349, £62,783; total revenue £57,775, £63,497; working expenses £34,825, £42,425; sinking fund £5,862, £6,947; contribution to rates £3,750, £5,500; car mileage 1,140,019; 1,113,517; passengers carried 13,809,189, 15,455,163; working expenses per car-mile 7·33d., 9·14d.; power cost per car-mile 1·207d., 1·314d. The tramways serve a population estimated at 120,000.

UNITED STATES ELECTRIC RAILWAY WAR BOARD.

In a recent report of the War Board a list of thirty-eight bulletins, which were issued for the information of electric railway companies throughout the United States, is included. The bulletins deal with a great variety of subjects, such as coal conservation, skip-stops, electric railway war utilities, return load bureaus, etc. Street railway companies throughout the country have been very active in assisting the Government in every possible way.

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PERSONAL.

Councillor Rudd has been appointed chairman of St. Helens Corporation Tramways Committee.

Mr. F. W. Bricknell, city engineer of Hull, has been granted an increase in salary of £250, to £1,000.

Mr. Clifford C. Paterson joins the General Electric Company, Limited, as Director of Research Laboratories, as from January.

Sir Auckland Geddes, President of the Local Government Board, has become vice-president of the London Safety First Council.

Mr. George Balfour, managing director of Messrs. Balfour, Beatty, the Coalition candidate for Hampstead, was elected by a majority of nearly 10,000.

Sir John Snell has been appointed by the Board of Trade to act as their adviser on all matters arising out of the report of the Electrical Power Supply Committee.

Mr. Cecil Leigh, F.I.C., chief chemist of the Birmingham Metal and Munitions Company, Limited, has been appointed general manager of Thermit, Limited.

Private Williamson, Seaforth Highlanders, who has been awarded the Military Medal, was prior to enlisting a car driver in the employment of the Dundee, Broughty Ferry, and District Tramways.

Mr. Richard Mayne, chairman of the Newcastle Corporation Tramways Committee, is deputy Lord Mayor for the present year. The vice-chairman, Councillor M. Sutherland, is Lord Mayor.

Mr. A. B. McKenzie, deputy chief engineer of the Manchester Corporation Electricity Department, has resigned his position, and will join the staff of Messrs. C. P. Sparks, consulting engineers, of London.

Sir John A. F. Aspinall, who has been general manager of the Lancashire and Yorkshire Railway Company for the past 20 years, is retiring at the end of the year, and will be appointed a director of the company.

Mr. H. Pilling, general manager, Accrington Corporation Tramways, has been granted an increase of salary from £400 to £500 per annum, subject to his undertaking not to seek another appointment for two years.

Mr. W. MacGibbon has been appointed manager of the Mexborough and Swinton Tramways Company. He has been manager of the Dewsbury and Ossett Corporation and Soothill Nether Urban District Council Tramways.

Mr. Evan Parry has resigned the position of chief government electrician of New Zealand to accept the appointment of engineer-in-chief of the English Electric Manufacturing Company, particulars of which are given elsewhere in this issue.

Superintendent A. E. Bassom, of the Public Carriage Department of the Metropolitan Police, was one of the twenty-four police officers in England who were awarded the King's Police Medal among the recipients of honours announced on New Year's Day.

Bombadier W. Simmons, R.G.A., who has been awarded the Military Medal for bravery in the field, was a motorman in the employ of Burnley Corporation Tramways when he enlisted in October, 1914. He went to the front in November, 1916.

Mr. Rees Jeffreys has resigned the secretaryship of the Road Board to accept the position of financial adviser to the Motor Union Insurance Company, Limited, of which he was one of the founders and original directors. He has also been elected chairman of the Federated British Insurance Company, Limited.

Sir George Gibb has, it is stated, resigned the salaried post of chairman of the Road Board, which he has held since its formation in 1910. He is, it is added, accepting the position of consulting general manager of the North Eastern Railway, of which he was solicitor for many years and general manager from 1891 until 1906.

Mr. W. J. Steele, city engineer of Newcastle, has been granted an increase in salary from £1,000 to £1,200. A recommendation for an increase in his salary was proposed in 1914, but owing to the outbreak of war the city engineer thought the time was not then opportune and at his request the proposal was withdrawn. Mr. Steele has been serving abroad for some time.

Councillor J. Teago, of the Newcastle-upon-Tyne Corporation, has been presented with a silver tea service for Mrs. Teago, in recognition of his work as an auxiliary tramway driver during the early days of the war. In making the presentation, Councillor R. Mayne (chairman of the Tramways Committee) said that Newcastle was the first town to introduce auxiliary tramway workers, and during 18 months Councillor Teago had turned out at 4 o'clock in the morning to drive the workmen to the shipyards and factories in the city. Councillor Teago suitably replied on behalf of his wife.

Mr. A. A. Blackburn, chief engineer to the Belfast Corporation Tramways, has resigned his position on his appointment as general manager of the Huddersfield Tramways. The Belfast Tramways Committee have accepted the resignation with regret, and have expressed their appreciation of the manner in which Mr. Blackburn has discharged his duties since his appointment on the reconstruction of the tramway system in 1905, and their best wishes for his future welfare in his new position. Belfast Tramways Committee have placed on record their appreciation of the efficient and reliable manner in which Mr. Blackburn has discharged his duties during his 14 years' service in Belfast.

The New Managership at Bury.—Bury Tramways Committee interviewed four applicants, out of 42, for the position of manager of the Bury Corporation Tramways. The selected candidates were Messrs. C. J. Baker, traffic manager, Blackpool Corporation Tramways; H. Beetson, chief clerk, Bury Corporation Tramways; Frank Buckley, general manager, Wigan Corporation Tramways; and A. B. Hayes, depot superintendent, Bury Tramways. On December 23 the Committee appointed Mr. Buckley to fill the vacancy, subject to confirmation by the Council. Mr. Buckley has been at Wigan for six years, and has reorganised the tramways there under circumstances of great difficulty. He was formerly assistant to the general manager at Salford.

Mr. R. H. Wilkinson, the late tramways manager of the Huddersfield Corporation, who has recently been appointed to a similar position at Bradford, has received a presentation from the chief officials of the Corporation as a token of their goodwill and esteem. The Town Clerk (Mr. J. H. Field), in making the presentation, which took the form of a handsome silver tray, referred to the cordial relations which had always existed between Mr. Wilkinson and his brother officials, and to the great extension and improvement in the position of the Huddersfield tramways undertaking during the 14 years that Mr. Wilkinson has been manager and engineer. He had no doubt that the same success would attend Mr. Wilkinson's service under the Bradford Corporation. Other principal officials tendered congratulations, and Mr. Wilkinson suitably responded.

Mr. William Clough was entertained to dinner by the Executive Council of the Municipal Tramways Association at the Municipal and County Club on December 19. Mr. T. B. Goodyer, president of the Municipal Tramways Association, presided, and Sir J. W. Courtis, vice-president of the Association, and Mr. J. B. Hamilton, chairman of the Executive Council, were amongst those present. Mr. Clough recently resigned the positions of general manager of the Bury Corporation Tramways and honorary secretary of the Municipal Tramways Association in order to accept an appointment with an important paper manufacturing syndicate. Eloquent testimony was given by the chairman and others of the high regard and esteem which Mr. Clough has won from his colleagues, and the thanks of the Council were expressed for his services to the Association, together with cordial good wishes for success in his new position.

We deeply regret to record the death of **Mr. Cecil Bickersteth,** of Messrs. Robert Kearsley and Company, which occurred on December 2, after a short illness, a severe attack of influenza developing into pneumonia. Mr. Bickersteth was a member of the Tramways and Light Railways Association, and was greatly esteemed by many friends in the tramway industry, who deplore his early death.

CONTRACTS AND ORDERS.

Walsall Corporation have accepted a tender for varnishes from Docker Brothers, Limited.

Cumberland Engineering Company have an order from Walthamstow Council for two sets of apparatus for dealing with tube corrosion.

Salford Tramways Committee have accepted a tender for 54 British steel tires from Cammell Laird and Company, Limited, at £339 12s.

The British Electric Vehicles, Limited, are supplying a 20-cwt. electric truck fitted with ironclad exide battery to Hull Corporation for the collection of street sweepings.

East Ham Corporation have been recommended to accept the tender of the Shrewsbury and Challiner Tyre Company, Limited, for repairing two wheels of a motor fire engine.

Electric Vehicles for Taunton.—The Town Council propose to apply to the Local Government Board for sanction to a loan of £4,500 for the purchase of three electric vehicles.

London and Brighton Electrification.—The General Purposes Committee of the Brighton Corporation have sent a resolution to the general manager of the London, Brighton and South Coast Railway, strongly expressing the opinion that the main line between London and Brighton should be electrified at the earliest possible moment.

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TRAMWAY AND LIGHT RAILWAY NOTES.

BARROW-IN-FURNESS.

PROPOSED MUNICIPALISATION OF THE TRAMWAYS.

Barrow-in-Furness Corporation are considering the question of taking over the tramway undertaking, which is one of those associated with the British Electric Traction Company, Limited. A decision will have to be reached within the next six months, or the opportunity of purchase will not occur for another seven years.

BLACKBURN.

LATER CARS.

The Tramways Committee have extended the running of the cars from 10 p.m. till 10.30 p.m. For some months the service has been stopped at 10 o'clock, and there have been recently strong protests at the cars leaving the centre of the town so early.

BATH.

AGREEMENT FOR INCREASED FARES.

A committee of the Corporation has received a letter from the manager of the Bath Electric Tramways accepting the terms of the draft agreement providing for an increase in fares and asking that the period in which the increase should be charged might extend beyond the six months named, if the circumstances justified it, as long as the Board of Trade might direct. It was to be understood that the agreement did not preclude the company from asking for a further increase in fares if it became necessary.

BELFAST.

APPLICATION FOR SERVICE MEN—INFLUENZA VISITATION—CAR MAINTENANCE.

Belfast Tramways Committee have resolved to apply to the military authorities for the release of all employees who are at present serving with the colours. Councillor Turner, chairman of the Tramways Committee, recently told the Council that during the past few weeks there has been the greatest difficulty in maintaining the ordinary service. Early in December, there were 127 men down with influenza and there had been several deaths. At a meeting of the Council some weeks ago, Councillor Duff alleged that car repair work was twice as costly as at Glasgow. At the last meeting Councillor Turner said that Mr. Duff had quoted wrong figures in regard to the number of cars at Belfast. Instead of 190 they had 290 cars, and considering the number of cars the cost of general maintenance and repairs in Belfast was almost the same as at Glasgow. Before councillors attempt to criticise managers, it would be an advantage, and a saving of time, if they would take the pains to verify the information.

BIRMINGHAM.

A COURAGEOUS MOTORMAN.

At a meeting of the Tramways Committee, the Lord Mayor (Alderman Sir David Brooks) presented motorman Jesse Robinson with a guinea, awarded him by the committee for specially courageous conduct in stopping a runaway horse in Aston Road. About two years ago Robinson received similar recognition for his prompt action in stopping his car, and thereby saving the life of a child.

BRADFORD.

ELECTRIC WELDING OF JOINTS—PARCEL TRAFFIC.

In the annual report of the Corporation Tramways, it is stated that a contract has been entered into with the Rail Welding Company to repair 200 hammered rail joints as an experiment by the "quasi-arc" system of electric welding. A number of joints have been repaired and the contract has been further extended. Fish-plates were welded to the rail and the running surface of the rail, which was hammered out near the joint, was re-treaded. The work was carried out at night after the car service had been discontinued, and it has resulted in a great improvement in the permanent way. The income for the last financial year from parcel traffic on the Corporation Tramways showed a substantial advance, due largely to increased rates and munitions traffic; but owing to increased expenditure the surplus was only £718. The total number of parcels carried was 598,902, compared with 644,064 the previous year. The department is divided into two sections, viz., parcels and motor haulage. The earnings per parcel averaged 3·804d., and the cost 3·721d., leaving a profit of ·083d. per parcel.

CARDIFF.

NEED FOR "SAFETY FIRST" TEACHING.

While absolving the driver from responsibility in regard to the death of a four-year-old child, who was knocked down by a tramway car, the Cardiff Coroner expressed the view that instructions should be given to drivers that, when there was an element of danger such as this—a little child, who did not know what danger was, standing in the road, although apparently safe—it was imperative that they should pull up.

DUDLEY.

THE COMPANY TO PROVIDE SHELTERS.

The associated companies owning the tramways at Dudley have agreed to provide several shelters on the line of route subject to the Corporation lighting, maintaining, and policing them. The Streets Committee of the Corporation have recommended the acceptance of the terms.

GLASGOW.

FEWER CARS AND INCREASED RECEIPTS BADGE FOR 25 YEARS' SERVICE.

In spite of the restricted car service the tramway receipts are being well maintained, the income for the week ended December 7 being £28,343 against £27,627 for the previous week, and £26,611 for the corresponding week a year ago. Mr. Dalrymple, the general manager, stated that there is little hope of an immediate return to the normal service. With the coal supplies slowly diminishing, there is indeed a prospect of further curtailment. The Tramways Committee propose to grant a special badge to all employees who have continued in the service of the department for 25 years.

LIVERPOOL.

RE-ARRANGEMENT OF THE OFFICES—FEWER STOPS AND REDUCED ENERGY CONSUMPTION.

Liverpool Tramways and Electric Power and Lighting Committee now meet at the well-appointed head offices, Hatton Garden, where a spacious room has been provided for the meetings of the committee, which will in future regularly take place there. The change has the advantage of concentrating everything relating to the undertaking under one roof, where all the records will be kept. The whole scheme includes a reference library, which when completed will afford each member of the committee an opportunity of posting himself on matters relating to the undertaking. Cordial recognition was given to the general manager, Mr. C. W. Mallins, for his efforts in arranging for the excellent accommodation.

LONDON.

UNIONS WITHDRAW FROM CONCILIATION BOARD—COUNTY COUNCIL TRAMWAY MATTERS—ARMISTICE PAYMENT TO EMPLOYEES.

As the result of the two unions catering for tramway employees having joined the National Transport Workers' Federation, the Traffic Conciliation Board of the London County Council is likely to be non-effective. It has been reported to the Council that the employees' representatives had tendered their resignations, and that although the usual steps were taken under the conciliation scheme to secure nominations, none were received. The Highways Committee state that the Board can be fully constituted whenever the employees so desire. The Board was inaugurated under the Board of Trade scheme, and it is the only organisation of the kind dealing with the grievances of the road traction employees. During its few years' existence it secured many valuable concessions. In view of the labour problems confronting tramway authorities, and of the need for frequent conferences of the Municipal Tramways Association, the County Council recently appointed Messrs. G. H. Hume, A. H. Scott, and W. J. Squires to represent them at such conferences until December 31, 1918, and Messrs. G. H. Hume and A. H. Scott as from January 1, 1919, until further orders, together with the general manager of the tramways. In view of the work of tramway operation being carried on under abnormal conditions at the conclusion of the armistice, the Council granted the operative staff an allowance of a day's pay, entailing an expenditure of £5,211.

MANCHESTER.

PASSENGERS STANDING UP BEFORE STOPS.

A recent decision of Mr. Justice Bailhache at the Manchester Assizes that "a person who gets up in a tramcar before it stops does so at his or her own risk," has caused a great deal of discussion. Councillor Ross Clyne has given notice that he will move that a public pronouncement be forthwith made by the Tramways Committee bearing upon the decision. The case was one in which a passenger claimed damages for injuries through being thrown into the roadway when the car went over points.

NEWPORT.

AN INSTITUTE FOR TRAMWAY EMPLOYEES.

A new institute for the tramway employees of the Corporation has been opened by the Mayor (Councillor Parfitt). There was a parade of the employees, headed by their band—accompanied by contingents of tramway employees from Cardiff and Pontypridd. Among the speakers at the ceremony were Sir John Courtis (chairman of Cardiff Tramways Committee), Mr. Arthur Ellis (tramways manager, Cardiff), and Councillor John Moxon (chairman of the Newport Tramways Committee). Mr. A. J. Attwell (secretary of the Tramways and Vehicle Workers' Union) and Mrs. Attwell were presented, the former with a watch and chain and the latter with an umbrella. Councillor Moxon announced that if the institute was well conducted the Corporation would increase its contribution by £300. Sir John Courtis thanked Newport for giving the lead to Cardiff and other towns in this matter.

NOTTINGHAM.

RESULT OF FEWER STOPPING PLACES.

Mr. R. H. Swain, chairman of the Nottingham Tramways Committee, in answer to a question at the Council meeting, said that the reduction in the number of stopping places had adversely affected the revenue of the tramway undertaking, but it had effected a saving in electric current.

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ST. HELENS.

QUESTION OF EXTENDING THE COMPANY'S LEASE.

St. Helens Tramways Committee have declined to extend the tramway lease, which lapses in October next, and have recommended the Corporation to work the tramways themselves.

SHEFFIELD.

NEW CAR DEPOT AT CROOKES—SHELTER FOR PASSENGERS—PASSES FOR BLIND PERSONS.

The Tramway Committee are proceeding with the erection of a new car depot at Crookes. A shelter is to be erected at the junction of Town Lane and Fulwell Road. Sunday morning munition workers' cars have been withdrawn, and free passes are to be issued to blind persons. A grant of £20 has been made to Sheffield Military Hospital fund, and £200 to the West Riding and Sheffield District Rifle Association. Double pay has been granted to the traffic employees for time worked on armistice day.

DEMANDS FOR SHORTER WORKING HOURS.

TRAMWAY MEN'S 44 HOUR WEEK.

The National Transport Workers' Federation have forwarded to the Municipal Tramways Association and the Tramways and Light Railways Association, covering respectively the municipally and privately owned tramways in the United Kingdom, the following list of demands:—

(1) That the working week shall consist of 44 hours, inclusive of signing on and signing off.

(2) That every employee shall be guaranteed a working week of 44 hours or payment equivalent thereto.

(3) No day's work shall be in excess of eight hours.

(4) In no circumstances shall a reduction in the working day entail a reduction in existing wages.

(5) No spread-over duty shall exceed nine hours, inclusive of meal times or relief.

(6) All national holidays, Sunday, and overtime labour to be paid for at the rate of time and a half.

(7) All employees shall be granted 14 days' holiday annually with pay.

A meeting of representatives of the tramway companies connected with the Tramways and Light Railways Association was held on January 3, at Caxton Hall, to consider the demands put forward by the National Transport Workers' Federation, which were given in our issue of December 28. These demands include, among other concessions, a 44 hour week for tramway employees. A committee was appointed to confer with the committee which it was expected would be appointed at a meeting in Manchester of representatives of the municipal tramways on January 10. The joint committee it is anticipated will later confer with representatives of the National Transport Workers' Federation, with the object of arriving at some basis of agreement.

It is estimated that these demands, owing to the great additions to the number of employees necessary, would mean an average increase in working expenses of more than 25 per cent. In many towns the increase would be greater than this and the burden would be more than the industry could bear.

PORTSMOUTH TRAMWAY RECONSTRUCTION.

Mr. W. R. Spaven, general manager of Portsmouth Corporation Tramways, has submitted to the Mayor, Mr. John Timpson, who is also chairman of the tramways committee, a memorandum dealing with the necessary reconstruction and extension of the tramway system. The memorandum states that a very large amount of work will have to be taken in hand, so soon as arrangements can be made. Mr. Spaven says:—

"The returns for this year show an increase over the pre-war year (1914) of about 14,000,000 passengers, which works out at 17·7 per car-mile. To deal with this traffic we have 100 cars, and during last summer we had an average of 92 cars in daily service, leaving the small margin of eight for general overhauling purposes, and the carrying out of ordinary running repairs, which clearly shows that our present rolling stock is altogether inadequate to meet the traffic demands.

"If this traffic is maintained, and I see no reason why it should not be so, and in view of what may take place in Portsmouth during the coming summer, and as there is no possibility of obtaining any additional new cars for some time to come, we shall be faced with a very serious traffic problem, and the only solution of the same is, in my opinion, for the committee to consider the advisability of obtaining, if possible, some motor omnibuses, which could be run from outlying districts to the centre of the town, through thoroughfares quite clear of the tramway route.

"These omnibuses would also be useful when the reconstruction of the track is taken in hand for conveying people when the car services are disorganised."

The schedule of work that Mr. Spaven recommends should be taken in hand at the earliest practical moment is as follows:—

Repairs and Renewals.—Permanent way, overhead equipment, cars.

New Work.—Cars (top roof covers and vestibules); car shed; converting some of the old cars into the toast-rack type; extension of tramways—(*a*) Milton and Hilsea; (*b*) through Chichester Road, linking up London Road and Copnor Road; (*c*) through St. Michael's Road, linking up main line and Floating Bridge line with Park Road section; alterations at the Town Hall and other parts for dealing with the traffic; Bradford junction; motor omnibuses.

PATENT LIST.

Abstracted for "The Tramway and Railway World" from the Official Journal of Patents.

***** If the inventions have been communicated the names of the communicators are given in italics.**

APPLICATIONS FOR LETTERS PATENT.

The number of the patent is given in brackets.

Means for starting internal combustion engines of motor cars, etc. (19,365)—A. J. Adams.

Suspension and adjustments of brakes for motor, etc., vehicles (19,450)—Arrol-Johnston, Limited, G. W. A. Brown, and E. G. Grinham.

Change speed gear actuating mechanism and locking devices (19,451)—Arrol-Johnston, Limited, G. W. A. Brown, and E. G. Grinham.

Radiators for engines of motor vehicles (19,555)—G. Clark.

Combined sleepers and chairs for railways (19,511)—S. C. Clayton.

Vehicle wheels (19,482 and 19,483)—Dunlop Rubber Company and C. Macbeth.

Audible and visual indicator for automobile vehicles (19,667)—E. L. Harley.

Variable speed gear (19,406)—J. Nelson.

Transmission mechanism for motor vehicles (19,594 and 19,695)—R. D. Nuttall Company.

Lifting jacks for use on motor vehicles (19,703)—F. L. Rapson.

Springing systems for motor vehicles (19,739)—A. W. Reeves.

Visual and audible electric indicators (19,814)—J. G. Rose.

Foot pedals for motor vehicles (19,566)—F. Le H. Salmon.

Rims for motor vehicles (19,544)—R. H. Shawcross and J. Watson.

Means for locking chair keys or wedges of permanent way (19,762)—O. G. Taylor.

Reinforced concrete sleepers (19,633)—F. G. Wright.

Chassis for motor, etc., vehicles (19,870)—J. Budge.

Body part of motor, etc., vehicles (19,871)—J. Budge.

Leaf springs for suspension of motor vehicles (19,872)—J. Budge.

Lifting jacks for motor vehicles (20,154)—L. C. Burgess.

Electrical equipment of motor vehicles (19,955)—W. A. Cocking and W. E. Hean.

Construction of motor parts of automobile vehicles (20,093)—M. A. Delque (*née* Habans) and C. M. Motte.

Automobile vehicles (20,211)—M. A. Delque (*née* Habans) and C. M. Motte.

Track switches (20,158)—R. Dempster and Sons and W. Hargreaves.

Overhead electric trolleys (20,068)—J. Ford.

Motor vehicles (20,100)—H. C. Gibson.

Automobile, etc., wheels (20,152)—E. F. Goodyear.

Variable speed transmission gear (19,936)—G. C. E. Hampden.

Automatic apparatus for lubricating railway and tramway track wheels and rails (20,179)—A. Hofmann.

Power transmission and variable speed gear mechanism for motor cars (19,965)—F. Hopley.

Variable speed transmission gear (20,007)—W. J. Masser-Horniman and G. Richards.

Overhead electric trollies (20,068)—E. H. Jackson.

Apparatus for testing vacuum brakes on railway trains, etc. (19,899)—E. S. Luard.

Apparatus for testing vacuum ejectors on railway locomotives for brake purposes (19,900)—E. S. Luard and V. P. Rawlings.

Motor vehicles (20,100)—A. W. Marchant.

Motor car bodies (20,341)—W. Matthewman and E. Sandow.

Controlling railway points and signals (20,376)—A. Monard.

Motor vehicles (20,061)—M. R. Moore and H. L. Zeitun.

Brakes for electrically propelled vehicles (20,177)—P. A. H. Mossay.

Electrically propelled trucks, etc. (20,178)—P. A. H. Mossay.

Signal for motor omnibuses and tramway cars (19,968)—R. G. Price.

Automatic couplers for railway, etc., vehicles (19,855)—T. F. Redington.

Means for supporting overhead conductors on railways, tramways, etc. (20,285)—B. J. Rees and E. H. Whittall.

Power transmission gear for motor vehicles (19,932)—F. Warren.

Jacking up or lifting motor vehicles (20,599)—F. W. Baker.

Motor vehicles (20,857)—C. J. Bamford and J. Bamford.

Motor vehicles (20,845)—G. Barker.

Brakes for motor vehicles, etc. (20,659)—G. E. Bradshaw.

Three-wheeled motor vehicles (20,700)—S. Goodwin and Castle Motor Company.

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Portable electric starter for motor car engines (20,713)—C. B. Cave-Browne-Cave.
Construction of bodies of motor vehicles (20,824)—F. M. Charles.
Speed or mileage indicators (20,841)—R. Courty.
Motor vehicles (20,510)—C. W. Fulton.
Motor car bodies (20,511 and 20,512)—C. W. Fulton.
Automobile wheels (20,808)—E. F. Goodyear.
Railway signalling systems (20,557)—T. J. Hornblower and MacKenzie, Holland and Westinghouse Power Signal Company.
Wind screens for motor vehicles (20,517)—G. Purvis-Russell-Balfour Kinnear.
Steering and control mechanism for motor vehicles (20,454)—F. W. Lanchester.
Speed indicators (20,829)—O. D. Lucas and H. P. Martin.
Direction indicating or signalling system for motor vehicles (20,776)—A. McLeod.
Means for presenting directions to drivers of mechanically propelled vehicles (20,670)—R. A. Miles.
Controlling railway points and signals (20,451)—A. Monard.
Motor car power transmission system (20,467)—H. R. Morgan.
Trolley heads for electric traction (20,619)—J. B. Parker and J. Smith.
Apparatus for operating railway points, etc. (20,881)—A. C. Rose and Saxby and Farmer.
Automatic signals (20,892)—E. G. Shane.
Electrically driven vehicles (20,411)—J. E. Stott.
Detachable rotary splash guard for motor omnibuses, etc. (20,438)—G. Tydeman.
Starting internal combustion engines on motor vehicles (20,421)—J. Walster and S. Walster.
Points for tramway, railways, etc. (20,950)—E. Allen & Co. and E. Larmuth.
Variable speed transmission gear (21,190)—D. J. W. Baxter and Palladium Autocars, Limited.
Braking motor vehicles (21,414)—M. Birkigt.

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Lubricators for locomotives, etc. (21,461)—J. Bliss.
Speed recorders (21,001)—E. S. Carey.
Direction indicators for vehicles (21,075)—J. N. Casson.
Front axles for motor cars, etc. (21,210)—J. R. Churchill.
Seat for tramway cars, etc. (21,428)—J. Harper.
Apparatus for grinding tramway rails (21,361)—W. L. Lorkin.
Detachable disc wheel for motor cars (20,907)—H. R. Morgan.
Reducing splashing from motor vehicle wheels (20,962)—A. Podmore.
Driving gear of motor cars (21,267)—F. J. Sabel.
Rear axle structures for motor vehicles (21,136)—A. C. Scott.
Operation of motor car gears and brakes by compression on air pressure derived from car main engines (21,447)—S. C. Winfield-Smith.
Front steering axles of motor vehicles (21,203)—W. Starley.
Apparatus for operating points of railways and tramways (21,065)—H. A. Thomson.
Wheel for collecting power from overhead electric wires or cables and wire carrying wheels (21,109)—E. W. Waggett.
Combined lifeguard and shields for front wheels of motor omnibuses, etc. (21,067)—W. J. Wicks.
Permanent way for railways, etc. (21,207)—J. Willey.
Frictional change speed and reversing gear (21,718)—H. B. Barwise.
Motor vehicles (21,910)—Birmingham and Midland Motor Omnibus Company and L. G. W. Shire.
Change speed gears for motor vehicles (21,737)—W. G. Boonzaier.
Hauling gear of vehicles or trailers for tramways (21,536)—G. Cousins and C. Hanks.
Motor-driven vehicles (21,697)—S. G. Crowder.
Wheels for motor vehicles (21,898)—J. T. Faichney.
Traffic signalling devices (21,654)—P. J. Foy.
Construction of motor cars (21,729)—C. W. Harrison.
Change speed and reversing gears (21,661)—A. Huart.
Driving mechanism for motor vehicles (21,801)—E. J. Kane.
Motor vehicles (21,889)—G. W. Mascord.
Reversible variable speed gear (21,584)—J. C. Massier.
Reversing gear (21,882)—V. Mickelsen.
Flange lubricating devices for wheels of railroad cars (21,534)—A. Roth.
Change speed gears (21,513)—G. E. Stanley.

SPECIFICATIONS PUBLISHED.

1917.

Means for carrying gas upon motor vehicles (15,256—*120,237*)—A. Phillips.
Power transmission mechanism of locomotives, railway motor cars, etc. (15,501—*120,238*)—Baguley Cars, Limited, E. E. Baguley and L. Bentall.
Radiators for motor vehicles (16,285—*111,478*)—H. Jezler.
Railway ties (16,812—*120,278*)—W. C. Halleck.
Brakes for vehicles (14,618—*120,413*)—R. C. Pessell.
Automobile bodies (15,086—*110,554*)—J. A. Anglada.
Sanding devices for motor road vehicles (15,597—*120,415*)—T. de Estrada.
Fluid pressure braking apparatus (16,262—*120,430*)—J. W. Cloud and J. W. Cross.
Construction of electric collectors (17,014—*111,847*)—Soc. Anon. des Etablissements L. Bleriot.
Differential gearing for steering motor vehicles (17,780—*120,468*)—G. M. Blackstone, F. Carter, E. Carter, and R. E. Watts.
Solid rubber tires (11,854—*120,589*)—Dunlop Rubber Company and J. V. Worthington.
Petrol and like motors (16,291—*120,601*)—W. G. Ritchie.
Fluid pressure jacks (17,272—*120,637*)—E. Graham and G. Bowman.
Axles of motor vehicles (17,495—*120,643*)—W. Shepherd and G. H. Gibbs.
Fluid pressure braking apparatus (17,743—*120,652*)—J. W. Cloud.
Electro-magnetic clutches or brakes for the driving and change speed gear of motor road vehicles (16,749—*120,757*)—G. Pollard and Menco-Elma Syndicate.
Means for the support of crank cases, gear cases, etc., in motor vehicles (17,355—*120,780*)—S. E. Alley.
Fore axle for motor vehicles (17,356—*120,781*)—S. E. Alley.
Tramway cars and other passenger vehicles (17,257—*120,953*)—W. S. Laurie.
Radiators for motor vehicles (17,770—*114,821*)—H. Jezler.
Electric speed changing mechanism (17,871—*120,987*)—J. Carlier.
Liquid or other fluid pressure braking apparatus for motor vehicles (17,924—*120,988*)—E. Graham and G. Bowman.

1918.

Starting devices for motor vehicles (2,801—*120,324*)—J. Wilson.
Change speed gear for motor driven vehicles (189—*120,481*)—Daimler Company and T. Dawson.
Wheels for motor vehicles (2,437—*120,498*)—E. A. Vivinus and J. G. Raphael.
Variable speed gear (3,904—*120,506*)—J. Ruscoe and Company and G. H. Kenyon.
Operating mechanism for infinitely variable transmission gearing (14,503—*120,710*)—L. R. Jones.
Rear axle structures for motor vehicles (10,786—*121,089*)—Albion Motor Car Company and T. B. Murray.

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TRAFFIC RETURNS.

Tramway and Omnibus Undertakings in the United Kingdom.

NAME OF COMPANY OR CORPORATION.	1917. WEEKS ENDED.					1918. WEEKS ENDED.					AGGREGATE.		
	Dec. 1.	Dec. 8.	Dec. 16.	Dec. 22.	Dec. 29.	Nov. 30.	Dec. 7.	Dec. 14.	Dec. 21.	Dec. 28.	Wks.	1918.	Increase or Decrease.
	£	£	£	£	£	£	£	£	£	£		£	£
Aberdare U.D. Council	454	455	452	457	536	499	508	509	531	593	38	19,296	...
Aberdeen Corporation	2,006	2,146	2,022	2,015	2,167	2,393	2,534	2,455	2,505	2,532	30	78,138	+ 13,435
Ayr Corporation	340	331	335	333	354	382	395	425	408	418	32	20,502	+ 4,301
Belfast City	...	...	...	...	...	...	...	...	...	...	—	—	—
Birkenhead Corporation	1,865	1,840	1,835	1,929	1,717	2,141	2,207	2,203	2,258	1,965	39	85,746	+ 13,627
Blackburn Corporation	1,323	1,307	1,298	1,321	1,694	1,488	1,498	1,618	1,670	1,864	39½	71,486	+ 12,866
Bradford Corporation	7,242	7,384	7,658	6,858	7,405	8,529	9,122	9,268	9,749	9,090	39	362,072	+ 61,267
Burnley Corporation	1,809	1,845	1,812	1,807	2,054	2,115	2,221	2,368	2,400	2,690	—	—	—
Burton-on-Trent Corporation	331	323	334	375	346	391	405	430	449	430	39	16,110	+ 3,778
Bury Corporation	1,508	1,503	1,384	1,536	1,477	1,792	1,933	1,918	1,916	1,932	39	79,958	+ 15,269
Chatham and District	1,122	1,085	1,080	1,035	1,133	1,167	1,176	1,237	1,259	1,150	52	65,920	+ 340
Cork Electric	545	548	521	525	609	544	544	562	564	600	52	31,510	+ 2,844
Derby Corporation	1,256	1,216	1,158	1,332	1,045	1,361	1,442	1,498	1,556	1,470	39	58,737	+ 11,136
Dundee City	1,526	1,543	1,509	1,492	1,590	1,799	1,908	1,921	1,995	2,004	32	62,037	+ 12,192
East Ham Corporation	1,241	1,246	1,216	1,234	1,260	1,518	1,656	1,634	1,696	1,631	38½	61,018	+ 7,121
Glasgow Corporation	27,033	26,643	26,475	26,074	26,830	27,627	28,343	28,666	28,631	28,470	30½	863,917	+ 64,290
Glossop (Urban Elec. Supply Co.)	165	172	167	159	180	174	194	196	220	210	52	9,428	+ 1,314
Halifax Corporation	2,162	2,220	2,227	1,995	2,398	2,422	2,576	2,716	2,762	3,019	38½	109,360	+ 13,909
Halifax Corp. Motor Omnibuses	50	49	49	43	56	60	62	65	66	70	38½	2,572	+ 679
Huddersfield Corporation	3,118	3,120	3,056	2,962	3,251	3,641	3,588	3,605	3,632	4,430	39	142,568	+ 18,881
Ilford U.D. Council	...	...	...	...	...	...	...	...	...	...	—	—	—
Ipswich Corporation	556	518	555	618	575	568	615	674	727	659	39	29,609	+ 3,124
Isle of Thanet	143	140	144	172	204	255	292	300	332	397	12½	3,966	+ 1,840
Kilmarnock Corporation	212	209	204	207	222	260	276	279	273	292	32½	8,486	+ 1,931
Lanarkshire	2,808	2,840	2,901	2,738	2,859	3,455	3,329	3,609	3,491	3,474	52	184,390	— 39,935
Lancashire United	...	...	...	...	...	...	...	...	...	...	—	—	—
Leeds City	11,020	10,908	10,644	10,864	11,535	13,121	13,750	13,874	13,784	14,894	39	526,981	+ 96,458
Leicester Corporation	4,029	3,999	4,068	4,248	3,935	4,600	4,750	5,031	5,060	4,791	—	—	—
Leyton U.D. Council	1,813	1,820	1,746	1,733	1,827	2,290	2,391	2,461	2,599	2,533	39	92,015	+ 18,051
Liverpool Corporation	16,447	16,577	16,860	16,880	15,861	19,159	19,881	20,217	20,565	19,259	51½	952,911	+ 141,079
Llandudno and Colwyn Bay	225	214	223	222	270	258	214	288	286	361	4	1,149	+ 220
London County Council	55,386	55,801	54,241	54,571	50,310	66,179	67,646	69,769	71,492	69,139	38½	2,537,783	+ 403,285
Maidstone Corporation	226	220	211	215	263	226	250	261	283	297	38½	10,997	+ 1,452
Manchester Corporation	21,044	21,099	20,826	23,305	20,283	25,122	26,272	27,230	27,669	23,313	39	1,015,033	+ 202,997
Newcastle-on-Tyne Corporation	8,206	8,049	8,120	8,011	7,149	8,335	8,775	8,892	8,859	7,840	39	351,697	+ 45,685
New St. Helens and District	...	...	...	...	...	...	...	...	...	...	—	—	—
Northampton Corporation	844	809	829	866	912	868	904	942	1,000	1,008	39	33,954	+ 1,056
Nottingham Corporation	4,605	4,531	4,515	4,588	4,563	4,934	5,417	5,555	5,792	5,658	39	222,768	+ 49,432
Oldham Corporation	2,752	2,734	2,517	2,727	2,643	3,121	3,364	3,506	3,497	3,364	40	138,884	+ 25,758
Reading Corporation	1,056	1,052	1,043	1,053	1,038	1,137	1,217	1,262	1,320	1,194	38½	50,472	—
Rhondda Tramways	1,553	1,518	1,581	1,544	...	1,820	1,909	1,978	2,003	...	51	91,842	+ 15,136
Rotherham Corporation	1,829	1,880	1,876	1,923	1,742	2,341	2,268	2,265	1,903	2,395	39½	92,233	+ 20,395
Sheffield Corporation	12,658	12,519	12,804	12,878	11,100	12,709	13,136	13,034	12,960	11,551	39½	531,663	+ 50,127
Southampton Corporation	2,090	2,068	2,039	2,075	1,996	2,347	2,387	2,433	2,489	2,386	38½	98,541	+ 18,792
Southend-on-Sea Corporation	629	659	610	639	663	1,034	1,042	1,073	1,128	1,140	39	52,300	+ 16,613
South Shields Corporation	937	933	938	997	...	1,026	1,078	1,119	1,108	...	38	43,919	+ 7,719
Sunderland Corporation	1,877	1,849	1,831	2,004	1,858	2,089	2,186	2,284	2,416	2,321	39	84,315	+ 12,285
Swindon Corporation	...	...	...	...	...	...	...	...	...	...	—	—	—
Torquay Tramways	646	635	605	631	...	693	737	726	775	...	51	45,682	+ 11,859
Tyneside Tramways and Tramroads	777	786	...	...	...	828	881	...	...	...	23	23,358	+ 2,873
Wallasey Corporation	1,404	1,388	1,432	1,450	1,404	1,581	1,608	1,630	1,912	1,760	38½	73,023	+ 10,993
Walsall Corporation	...	...	...	...	...	...	...	...	...	...	—	—	—
Walthamstow U.D. Council	1,143	1,120	1,107	1,071	1,119	1,295	1,340	1,385	1,494	1,475	39	56,625	+ 8,587
Warrington Corporation	701	694	678	...	...	756	802	814	...	...	37	28,165	+ 7,418
West Ham Corporation	3,633	3,692	3,616	3,636	3,471	4,525	4,680	4,819	5,072	5,068	38½	176,957	+ 34,394
Wigan Corporation	...	2,137	2,142	2,106	2,357	...	2,530	2,602	2,605	2,424	39	96,563	+ 15,560

*** A number of undertakings have suspended the issue of traffic returns for the duration of the war.

Colonial and Foreign Tramway Traffic Returns.

NAME OF COMPANY.	1917. WEEKS ENDED.					1918. WEEKS ENDED.					AGGREGATE.		
	Dec. 1.	Dec. 8.	Dec. 16.	Dec. 22.	Dec. 29.	Nov. 30.	Dec. 7.	Dec. 14.	Dec. 21.	Dec. 28.	Wks.	1918.	Increase or Decrease.
	£	£	£	£	£	£	£	£	£	£		£	£
Anglo-Argentine	54,091	54,898	53,904	54,902	63,998	59,964	63,629	59,081	61,698	68,664	52	2,935,934	+ 215,317
Calcutta Rs.	69,214	71,998	71,852	69,569	...	85,849	83,161	80,809	84,177	...	51	31,185,206	+ 366,012
Madras Rs.	33,914	(2 weeks)	...	(2 weeks)	46,646	34,527	(2 weeks)	...	(2 weeks)	43,146	52	942,232	+ 94,912
Pernambuco	4,591	4,690	4,655	4,769	5,373	4,793	5,255	5,177	5,235	5,961	52	230,706	+ 26,199

Companies issuing Monthly Statements only.

	1917.						1918.						Wks.	AGGREGATE.	
	July.	Aug.	Sept.	Oct.	Nov.	Dec.	July.	Aug.	Sept.	Oct.	Nov.	Dec.		1918.	+ or −.
	£	£	£	£	£	£	£	£	£	£	£	£		£	£
Ballarat & Bendigo	2,563	2,766	3,072	3,546	...	...	2,948	2,996	3,430	3,690	...	...	28	23,520	+ 1,347
Brazilian Trac. Mlrs	7795000	8064000	7925000	8006000	...	...	9465000	9491000	9081000	8052000	...	...	43	85,782,000	+ 9,346,000
Brisbane	32,720	36,925	31,600	33,580	32,901	...	36,360	42,670	35,400	36,780	39,246	...	47	401,878	+ 40,559
British Columbia	$438,378	454,425	457,709	491,964	525,629	...	413,968	544,339	575,476	580,354	612,893	...	21	2,727,030	+ 358,925
Buenos Ayres L'c'z.	38,063	39,111	33,655	39,067	39,678	40,901	41,145	41,817	41,006	41,843	42,952	50,460	26	259,224	+ 28,748
Burma	26,288	26,714	26,167	28,955	27,760	...	34,848	41,855	30,836	34,848	34,407	...	17	141,946	+ 31,350
Cape Town	16,067	15,480	...	17,128	...	...	18,409	19,055	17,872	13,877	...	...	—	—	—
Carthagena & H.	5,763	4,164	4,306	2,805	3,932	4,424	5,491	2,729	2,549	2,525	2,988	2,950	52	46,864	− 2,702
Cordoba	14,343	14,233	...	...	...	...	...	15,734	...	...	...	...	21	79,054	+ 8,740
East India	1,183	1,562	1,512	1,229	871	1,099	1,968	1,975	1,939	2,044	1,947	2,048	21	9,953	+ 3,680
Kalgoorlie	2,713	2,911	...	...	...	...	2,798	3,340	...	...	...	...	34	22,123	+ 1,058
La Plata	3,876	4,075	3,450	3,742	...	...	6,722	4,382	4,999	5,334	...	...	47	56,826	+ 12,469
Lima	37,731	38,424	35,636	...	...	...	45,974	44,711	42,861	...	...	...	39	389,668	+ 67,475
Manaos Rs.	162,157	150,657	...	...	...	...	134,450	132,507	...	...	...	...	34	1,152,686	− 83,959
Manila $	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Monte Video	28,597	28,860	29,426	30,153	...	...	31,684	16,937	29,611	33,203	...	...	52	380,276	+ 20,444
Peruvian $	975,000	979,430	950,740	1047220	899 680	1101090	987.300	1029610	957,910	1090815	897,090	1057990	26	6,020,715	− 67,555
Port Elizabeth	3,544	3,360	...	3,885	...	...	3,395	3,725	3,661	2,751	...	...	—	—	—
Rangoon	4,783	4,788	5,163	5,667	5,358	5,438	6,055	5,760	6,067	6,566	6,611	6,188	52	71,992	+ 11,174
Toronto $	954,192	1039819	1023517	1043886	1052000	...	1049936	1070567	1119925	1048478	1071106	...	47	11,716,181	+ 729,183
Winnipeg $	242,797	248,457	267,170	301,772	305,881	...	288,155	288,974	285,670	295,005	283,721	...	47	3,252,863	+ 213,466

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Daimler

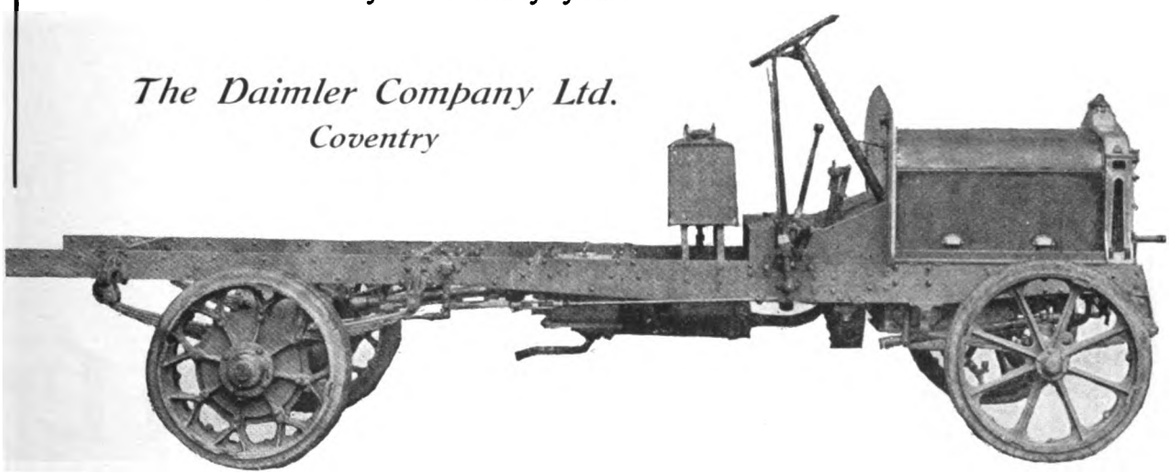
The Daimler Two-Ton Lorry

ONE thing demonstrated during the past four years is the outstanding efficiency of the Daimler Two-Ton Lorry. In all climes, under all conditions, Daimlers have maintained their reputation for reliability, power, simplicity, and economy.

ANOTHER thing demonstrated is the fact that there is no lorry TOO GOOD for a job that must be done regularly, with absolute certainty, and with despatch.

DURING the next few years there will be demonstrated in no uncertain degree the wisdom of regarding Prime Cost as only one factor, and a minor one too, in the estimation of the cost of motor lorry service. The prime cost of a Daimler Lorry covers more than a mere vehicle, it is absolute insurance of maximum efficiency over many years.

The Daimler Company Ltd.
Coventry



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NAPIER

MOTOR VEHICLES.

TWO MODELS

To Carry 30/45 cwt. & 3½ tons Respectively

"The Design and Construction are Throughout of a Character, which it would be Exceedingly Difficult, if not Impossible, to Improve Upon."

RAILWAY GAZETTE, March 31, 1916.

IN PEACE

USED BY THE LARGEST CARRYING COMPANIES AND COMMERCIAL HOUSES.

IN WAR

USED BY THE BRITISH AND ALLIED GOVERNMENTS.

D·NAPIER & SON LTD

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FROM WAR TO PEACE.

The past month has seen a steady and satisfactorily rapid removal of the restrictions occasioned by the war. The position as regards materials is notably better than was generally anticipated, and gives very little, if any, grounds for complaint. Altogether, it is clear that the Government's plans laid during the war with an eye to the period of demobilisation were more advanced than was generally believed. Some time must elapse before normal trading is the order of the day, but in the meantime very considerable numbers of vehicles are available to the general public and the supply will probably not fall far short of the demand in view of the continued difficulties in securing adequate supplies of fuel. In this respect, up to the time of writing, progress has been somewhat slow, and compares unfavourably with the prompt relaxation of restrictions found possible in France. Generally speaking, however, matters are moving so rapidly as to make it undesirable to attempt any criticism in notes which cannot reach the reader until some time has elapsed.

RUBBER TIRES FOR COMMERCIAL VEHICLES

Many amendments to the present Heavy Motor Car Order and Locomotive Acts are suggested in the report, which is summarised elsewhere in this issue, of the expert Committee appointed by the Local Government Board to consider the laws and regulations relating to the construction and use of road locomotives and heavy motor cars in Great Britain. It will be time enough to go into full details when there is an immediate prospect of the recommendations of the Committee becoming law. In the meanwhile we may consider the report primarily as indicating certain broad tendencies and constructional principles which it is clearly desired to encourage. From this point of view the most obvious deduction from the report is that any new law will practically compel the universal use of rubber tires on all heavy motor cars. In the first place we have the proposal that no metal tired vehicle shall be allowed to travel at anything above five miles an hour. Any such regulation would lead to the complete abolition of the use of metal-tires on 3-ton steam wagons. Then we have a further proposal that rubber-tired vehicles drawing rubber-tired trailers shall be allowed to travel at eight miles an hour. At present the 5-ton steamer is, with the exception of the heavier types of tractor, the only class of heavy motor car on which metal tires are fairly commonly fitted. The 5-ton steamer is admirably fitted to draw a trailer with an additional two or three tons of useful load under any reasonable conditions of road and gradient. Thus the proposed change would differentiate between the rubber-tired and the steel-tired five-tonner to such an extent as to make the latter comparatively a poor economic proposition. Furthermore, we have another suggestion to the effect that the diameter of wheels shall be increased all round. The proposed minimum for a rubber-tired wheel is 2 ft. 6 in. With metal tires, however, it is proposed that the minimum diameter shall be 3 ft. 3 in. for axle weights between four and five tons ; 3 ft. 6 in. between five and six tons, and 4 ft. above six tons. This means that the rear axle of a 5-ton lorry must be carried on wheels not less than 4-ft. in diameter unless rubber tires are fitted. Thus we have a series of proposals which, if passed into law, will make the rubber tire universal for practically all vehicles except the tractor.

THE USE OF TRAILERS.

Reference has been made to the proposal with regard to the use of trailers. This represents an important step in the right direction. At present the employment of trailers is definitely discouraged by law. In the course of a day's work we can deal with a bigger aggregate load on a 5-tonner with than without a trailer under most circumstances, provided that we take advantage of the higher speeds permissible if rubber tires are fitted. We would suggest that the new limit proposed, namely, eight miles an hour, might with advantage be raised even a little further so as to amount to a positive encouragement in the use of trailers. Also that the Committee should reconsider their views, which are at present to the effect that no passenger carrying heavy motor should be allowed to draw a trailer either for the carriage of extra passengers or for luggage. A trailer of limited dimensions, used exclusively for the carriage of luggage or other goods, might reasonably be drawn behind a passenger carrying vehicle. Its advantages would be particularly obvious in country services where the motor vehicle is required to act as a general carrier, and where, in many cases, the existence of low bridges and overhanging trees makes it impossible to provide safe accommodation for luggage upon the roof.

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AXLE WEIGHTS AND OVERHANG.

There is no suggestion that axle weights should be changed. We think that they might be slightly raised with great advantage on the score of economy and without doing any serious injury to the roads. An increase in unladen weights is suggested, but this does not amount to much so long as total laden weight and axle weight remain at the old limits. It is proposed to restrict the over-all length of heavy motor cars to 26 ft., which regulation it appears to us would be fairly harmless but somewhat unnecessary. It is also proposed to limit the overhang behind the rear axle to 7/24ths of the over-all length. On the whole we are inclined to favour this proposal. Excessive overhang gives a distribution of weight which is liable to cause injury to the roads. Furthermore, it increases the danger of driving in traffic and on grease, and often puts very serious stresses upon body work. In these notes we can only direct attention to a few of the numerous points raised by the Local Government Board Report, but we have endeavoured to indicate the directions in which the interests of readers are most likely to be affected one way or another by prospective alterations in the regulations. The report itself should be carefully studied, in order that probable changes in the law may be critically considered, and a body of expert opinion brought to bear on this matter, the importance of which can hardly be over-estimated.

AERIAL DEVELOPMENTS.

The recently published report of the Civil Aerial Transport Committee is the first comprehensive official statement on the subject of a development, and will unquestionably exercise immense influence upon the transport system of the world, and assist materially in the spread of civilisation and in the development of mutual understanding between the inhabitants of all countries. The Committee naturally considered in great detail the whole subject of international law as applied to flying, but the majority of our readers will be more interested in those parts of the report dealing with the early possibilities of aerial transport. A very interesting question is how far the Government must act as a proprietor of aerial services. On the whole, one is inclined to wish that the report could have been more definite on this point, and had supported the view, since expressed by Lord Weir that the State should act in this matter in the capacity of an elder brother, helping in the control and organisation but not endeavouring to establish anything in the nature of a monopoly. Official control is undoubtedly needed in order to prevent wild speculative ventures conducted under conditions of an unnecessary danger. Also the lives of passengers must not be trusted to pilots who are other than fully trained and certified in every way as entirely competent to perform their duties.

* * * * * *

Doubtless the first big development of aerial services will be in connection with the carriage of mails. Passengers will presumably be conveyed on mail routes, but for the time being they will occupy what must be called a secondary position. Private enterprise will at first cater for the conveyance of passengers in search of pleasure and novelty rather than bent upon business, although it will not be long before genuine business services will be instituted between large centres of population. At present there is much preliminary work to be done. The science of meteorology can bear further investigation, and will prove a surer guide now that observations in hostile countries are open to us. Wireless telegraphy and telephony will also need more careful adaptation, and offer scope for many improvements. Means must be devised for marking the positions of landing grounds and aerodromes by day and night, and means found to overcome the great difficulty of aerial navigation through or over fog or mist. Lord Weir mentions five years as the experimental period, after which regular aerial navigation in bad weather should be no more dangerous than present navigation on the sea under similar circumstances.

* * * * * *

For the carriage of goods the aeroplane has natural limitations. It cannot compete in cost per ton mile either with the railway or with the road motor wherever traffic is sufficient to justify the construction of the road or permanent way. It will only be used for general carrying purposes in the early stages of development of new countries, but it will find more general employment for the carriage of very perishable or urgently needed articles. Among these may be mentioned cinematograph films, which are typical of a certain class of product, the commercial value of which may be dependent upon the speed with which it can be provided. In such cases the aeroplane would obviously be favoured. Aerial mail services will carry light parcels as well as mails, and will have many advantages over the ordinary postal service, and also, from a different point of view, over the cable services. The aerial mail will be intermediate between the two, and will possess in a sufficient degree many of the principal advantages of both the established systems.

UNRESTRICTED USE OF MOTOR CARS.

INCREASED PETROL AND BENZOL SUPPLY.

The Board of Trade announce that the Motor Spirit Restriction Orders, the operation of which was suspended until January 10, has been revoked entirely as from that date.

Licences to obtain motor spirit are issued under the Finance Act, 1916, and the licence system must therefore remain in force. As previously announced, however, the Petrol Control Department is prepared to issue licences to new applicants, and to increase the quantities allocated to existing licence holders, and will endeavour as far as possible to meet all reasonable requirements.

Motor vehicles may therefore again be used for any purpose without restriction of distance.

The Petrol Control has advised Mr. F. G. Bristowe, general secretary of the Commercial Motor Users' Association, that motor spirit is now obtainable for motor chars-a-banc, and that this type of vehicle may be used on all routes which are not closed under legislation other than that now lapsing under the Motor Spirit Restriction Order. Motor spirit for motor chars-a-banc is, however, only obtainable under licence. Applications should be sent to the Petrol Control Department, 19, Berkeley Street, W.1.

Considerable quantities of benzol are now available as motor fuel, and the ordinary motor spirit licences can be used to buy benzol as well as petrol. After January 1, the Petrol Control Department will issue special supplementary licences available for benzol only. Stocks of petrol are very low, although they are expected to be normal next month. After January 1, if stocks permit, applications for more petrol will be considered from present licence holders, and applications will also be considered from those who do not hold licences. Holders of supplementary licences for benzol will be able to convert the whole of their allowance into benzol; the quantity of benzol allowed is half as much again as petrol.

Further information from the Controller, Petrol Control Department, 19, Berkeley Street, W.1.

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MOTOR TRAFFIC

STEVENS PETROL-ELECTRIC VEHICLES.

A Machine of Many Uses that has Won Success in War.

The 3-4 ton petrol-electric machines which are now being offered to the public by Stevens Petrol-Electric Vehicles, Limited, of 82, Victoria Street, London, S.W.1, embrace a number of very interesting characteristics. The chassis, which is of the War Office subsidy type, conforms in every way to the requirements of the department, and together with the electrical equipment is standardised throughout. At the invitation of Mr. W. A. Stevens, managing director of the company, a representative of The Tramway and Railway World recently visited the extensive works of Messrs. Dennis Brothers, at Guildford, where the Stevens machines are being constructed. A close inspection was made of the chassis and the component parts, and exhaustive tests to which the machines are subjected before passing out of the factory were witnesssed.

Although hitherto unknown to public users of motor vehicles, the Stevens petrol-electric machines have since the early part of 1917 been doing excellent service for the War Department. Large numbers of them have been in use in various fields of operation, both in this country and on the Continent, and have achieved remarkable successes. Especially is this so with regard to the running of searchlights and electric arc-welding. As the conditions under which those machines have been operated were of the most arduous character, the satisfactory results obtained are very gratifying to the company, for they clearly demonstrate the reliability and durability of both the mechanical and electrical equipment.

The designs of these are the outcome of many years' experience in the design and manufacture of commercial vehicle chassis and electrical transmission equipment. As is generally known, in the Stevens petrol-electric system the place of the gear box and clutch found in the ordinary petrol chassis is taken by an extremely flexible electric transmission, which has the effect of reducing the maximum driving strains between the engine and back axle by at least 50 per cent., while its speed and electrical generating capacity offer a wide range of usefulness, amongst which may be mentioned arc-welding, electric lighting, electric heating, power transmission and battery charging. An important feature in this connection is the fact that

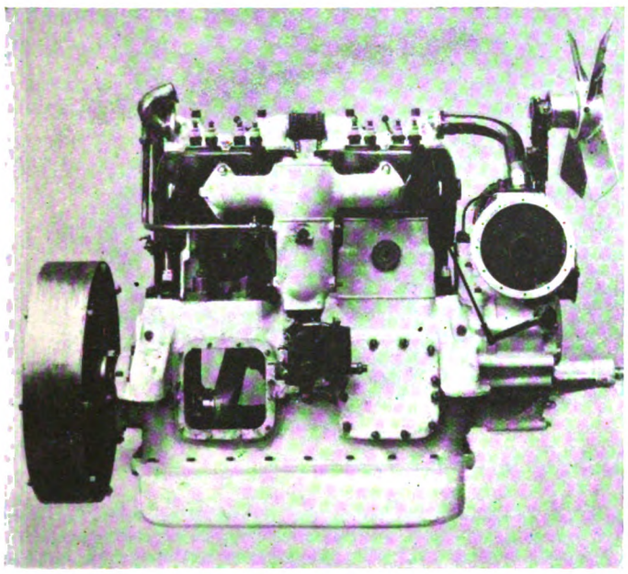

Fig. 1.—Engine.

by means of the Stevens system of control the generator can give a continuous output of 350 or 230 amperes at voltages varying from 60 to 120 respectively, and the characteristic of the machine can be immediately adjusted so that it will be under compound, level compound, or over compound, the latter feature being specially valuable when varying supply at constant voltage at the end of a long cable line is required.

The Stevens "A" type subsidy chassis is specially designed to carry gross loads of four tons. The engine (Fig. 1) has four cylinders, cast in pairs, the bore and stroke being 115 by 150 mm. respectively. The inlet and exhaust are placed on opposite sides, the valves being silently operated and entirely enclosed. The water circulation is maintained by means of a centrifugal pump placed in an accessible position. Accessibility is also a feature of the arrangement of the magneto, oil pump, carburetter, and fan drive. Large inspection doors are arranged in the crank case, the lower half of which can be dismounted without disturbing any of the working parts of the engine.

Ignition is by high-tension waterproof magneto of improved type, so arranged that it can easily be detached for adjustment or replacement. The speed of the engine is definitely controlled by means of a centrifugal governor, adjustable by a hand wheel mounted

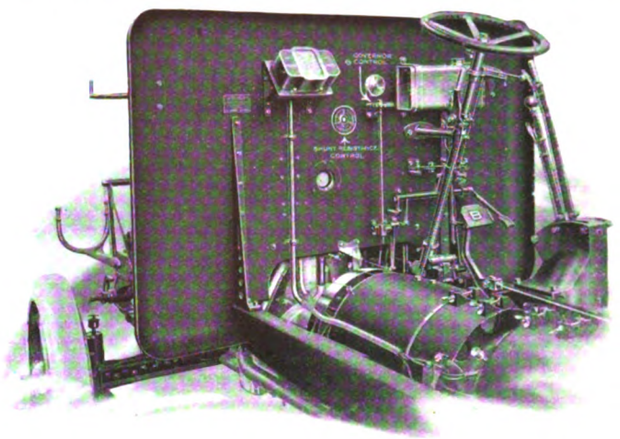

Fig. 2.—View of Dash showing Arrangement of Controls.

upon the dashboard. The carburetter is of the White and Poppe type, and has given very satisfactory results. The petrol tank is fitted at the back of the chassis frame, and has a holding capacity of 30 gallons. The petrol is drawn from the tank by suction to an "Autovac" petrol feed tank fitted to the dashboard under the bonnet, from which it is supplied to the carburetter.

The radiator is of the built-up type, with aluminium headers and vertical copper gilled tubes. It has an exceptionally large capacity, thus enabling the electrical equipment to be run at its full output when the vehicle is stationary. Although the water circulation of the cooling system is maintained by means of a centrifugal pump of large dimensions, the inlet and outlet pipes to the radiator are large enough to allow of thermo-syphon cooling without the assistance of the water pump. The radiator is mounted on rubber-lined trunnions, in order to protect it from road shocks, the portion carrying the tubes being easily dismounted from the top and bottom headers. Adequate protection from damage through collision is provided by means of the usual guard stays and cross tubes of the War Office pattern.

Lubrication of the working parts of the engine is by a combination of forced feed and splash, the oil sump at the bottom of the crank case carrying a supply of oil sufficient for a run of 3,000 miles.

Generator and Electric Motor Specifications.

The electrical equipment consists of a specially-designed generator, driven direct by the petrol engine, an electric motor direct coupled to the cardan shaft, and a reversing and speed-regulating controller of robust construction, bolted to the frame and provided with a weatherproof cover. The generator is of the four-pole interpolar type, compound wound, and provided with commutating poles. It is capable of delivering continuously a direct current of 230 to 350 amperes at a voltage of 120 to 60 respectively at from 1,100 to 1,200 revolutions per minute, or any smaller output within the above limits at a lower speed.

In the construction of the generator the greatest care is taken in the selection of the material and in the workmanship. Thus it will be found that the parts are accurately machined and good magnetic joints ensured throughout. The cover at the commutator end is provided with a sheet metal detachable shield, provided with a fixing device, special means of ventilation being also provided. Skefko radial ball bearings are fitted at the commutator end of the nickel steel shaft, and Hoffmann roller bearings at the other end. Each bearing is lubricated by means of a Stauffer lubricator attached to a brass tube screwed into the bearing cap.

The armature is of the slotted type, built up of stampings of "Lohys" material insulated on one side and provided with ventilating ducts. After winding, the armature is heavily bonded by

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steel pianoforte wire over a layer of mica. The commutator is built up of hard-drawn copper sectors insulated with pure mica, with steel rings clamping mica insulating end rings, the whole being bolted up under hydraulic pressure.

The brush gear is of substantial construction and heavily insulated. Each brush-holder is fitted with pressure fingers controlled by easily adjusted springs, so that the pressure is uniform throughout the life of the brush. There is a flexible metallic connection between the brush and brush-holder. All windings are thoroughly impregnated by the latest vacuum process.

The specification of the electric motor is identical with that of the generator, with the exception that the field coils are series wound instead of compound wound. The reversing switch and controller are carried in a separate case, and consist of a reversing switch having twelve tramway contact fingers, with screw adjustments, mounted on an insulated base. Upon the latter is carried the drum, heavily insulated from the spindle, and a multiple contact controller for speed regulation. The resistance units, which are easily renewable, are fixed on the base of the controller.

Fig. 3.—Stevens Petrol-Electric Machine—War Office Type.

The Controls—A Constant Voltage Ensured.

The control of the vehicle is effected by the throttle pedal of the engine in combination with a speed-regulating controller, the usual foot and side brakes being used The arrangement of the controls is shown in Fig. 2, also in the plan Fig. 4. This shows that the reversing controller has three positions—forward, neutral, and reverse, a safety catch being fitted to the lever to prevent the control being inadvertently moved to the wrong position. The speed-regulating lever, placed upon the left side of steering column, controls the speed of the vehicle by varying the relative excitation of the generator and motor fields, and in effect provides a perfectly gradual speed variation entirely free from shock

In the Stevens petrol-electric transmission the series field of the compound wound generator in series with a multiple contact resistance operated by the hand lever fitted to steering column acts as a variable shunt to the series winding of the electric motor, so that the strengthening of the generator field is accompanied by a corresponding weakening of the motor field and *vice versa*. The shunt current is not varied when driving, although a variable resistance is inserted in series with the shunt fields for use when the vehicle is employed in supplying current for searchlights, electric welding, or other purposes.

The above described form of regulation ensures a practically constant voltage of the generator when the vehicle is running on ordinary roads, and this allows of the supply through a fixed resistance to a 24-volt lighting battery carried on the car, the wiring to lights being on a 3-wire system. This enables standard 12-volt lamps to be used. Where a large supply of electrical energy is required—for example, in advertising—a 60-volt battery can be used.

When the car is used as a mobile generating station for supplying power for searchlights, electric welding, ordinary lighting, battery charging, or power transmission, the adjustable resistance in series with the generator series field winding acts as a variable shunt to the generator fields. By the adjustment of this resistance and the resistance in series with the shunt winding of the generator any desired characteristic can be obtained. The scheme of electrical connections shown in Fig. 5 is as follows:—

Description of the Electrical Control.

The shunt winding of high resistance in series with a multiple contact resistance is connected directly across the brushes of the generator for lighting purposes, and across the brushes of the motor for driving purposes—the change over being effected by the switch L.D.—and is capable of exciting the field to produce the required E.M.F. when no current is being supplied to the outer circuit. From the positive brush of the generator the circuit, after passing through the interpole windings, divides, one circuit being through the series field winding of the generator. This circuit is continued through a variable resistance to the movable contact of the resistance

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device, which in turn is connected to one terminal of the motor field winding. The other circuit is taken to one, say "*b*," of two intermediate terminals, "*a*" and "*b*," of the reversing controller.

The electrical connections of the reversing controller are as follow :—

Carried by, but insulated from, the controller spindle, and from each other, are two plain conducting movable segments, numbered 1 and 2. These are arranged concentrically with and symmetrically to either side of the spindle when the latter is in its mid-position. The segment 1 extends through an angular width of about 210°, and segment 2 through an angular width of about 150°. Mounted on an insulating base or carrier are four stationary contacts, *e*, *f*, *g*, and *h*, of which *e* is connected to terminal

When the spindle of the controller is in its mid or neutral position, as shown in B, Fig. 5, segment 1 electrically connects contacts *e* and *f*, but segment 2 does not connect *c* and *d*, as there is an interval of about 15° between its ends and the centre lines of the contacts.

By means of this controller it will be seen that the series field winding of the electric motor is connected across the terminals of the reversing controller, the negative brush of the motor being connected to the intermediate terminal *a*. The circuit from the positive brush of the motor to the negative brush of the generator is made by a low resistance conductor.

The switch connections are such that in the "forward" position of the controller (A, Fig. 5) the series winding of generator with its

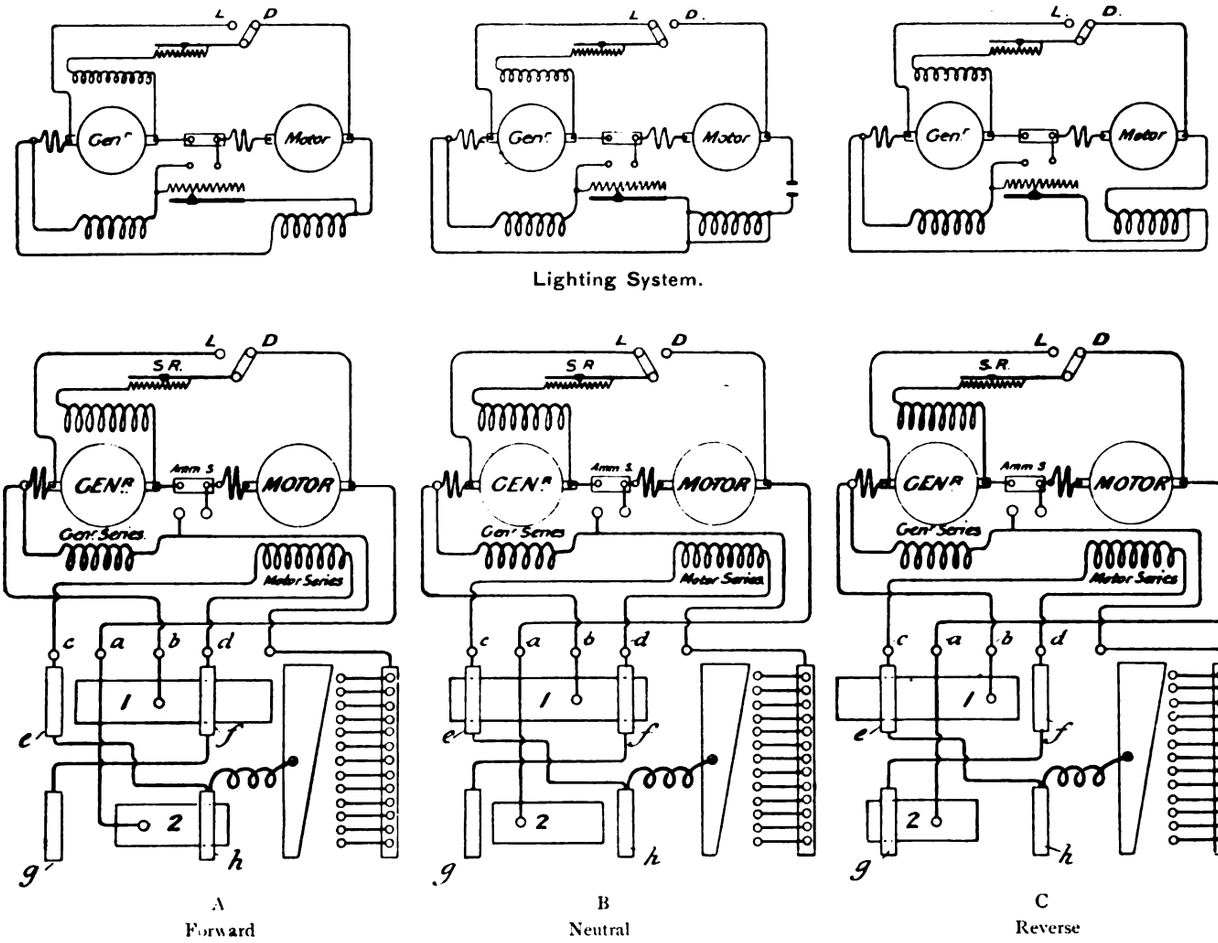

Fig. 5.—Scheme of Electrical Connections.

c, and *f* to terminal *d*. Contact *e* is so arranged that it can make contact with the left-hand side portion of segment 1, and contact *f* is so arranged that it can make contact with the right-hand side portion of the same segment, and contact *g* can make contact with the left-hand side portion of segment 2, and contact *h* can make contact with the right-hand side portion of the said segment 2 by suitable rotation of the segments. The contacts *e* and *g* are arranged in line and at an angular distance of about 180° from contacts *f* and *h*, which are also arranged in line with each other, the contacts being cross connected so that contacts *e* and *h* are electrically connected, as also are contacts *f* and *g*. Segment 1 is flexibly connected to terminal *b*, and segment 2 is flexibly connected to terminal *a*, which is connected to the negative brush of the motor. Terminal *d* is connected to one end of the motor field series winding, and terminal *c* is connected to the other end of such winding and to the movable contact of the resistance device. This device comprises a number of resistances adapted to be successively connected in parallel with one another by movement of the said movable contact in one direction and a short circuiting contact.

series resistance forms a variable shunt to the series fields of the motor, and the direction of current through the motor series field winding and armature causes the vehicle to be driven in a forward direction.

The generator series field winding is connected through the variable resistance to the terminal *c* of the motor series field winding. The generator series field winding and the motor series field winding are thus connected in parallel, and when the variable resistance is short circuited, the current through the generator field winding is approximately equal to the current through the motor field winding. By moving the contact of the variable resistance device in a direction to cut out successive parallel resistances in circuit with the generator series field winding, and thus increasing the effective resistance, the current through this winding will be reduced, and the current through the motor field winding will be correspondingly increased.

When the last fixed contact of the variable resistance device has been reached and passed, and the circuit of the generator finally broken, all the current from the generator will pass through the motor series field winding. By the arrangement described a large

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speed variation between the generator and motor is obtained. With the controller put into the reverse position (C, Fig. 5), the generator series field winding is connected in series with the motor series field winding, and is also shunted by a circuit of low resistance. As the resistance of the generator field winding is also low, sufficient current will then pass through the latter winding to well excite the generator, the shunt field winding of generator also assisting. The vehicle will then run in a reverse direction.

To use the electric generator for lighting or welding purposes it is necessary to put the reversing controller into the middle or neutral position (B, Fig. 5). The connection between the motor armature and its series field winding will then be broken, and the motor series field winding and the generator series field winding with the variable resistance will be short circuited. As one of the lighting terminals is connected to the junction of generator and motor armatures, and the other to the junction of the generator series field winding and the variable resistance, this resistance can be made to act as a variable shunt to the generator series winding, so any desired excitation can be attained, and the machine can be used either as an under, level, or over compounded generator at any voltage between 80 and 110.

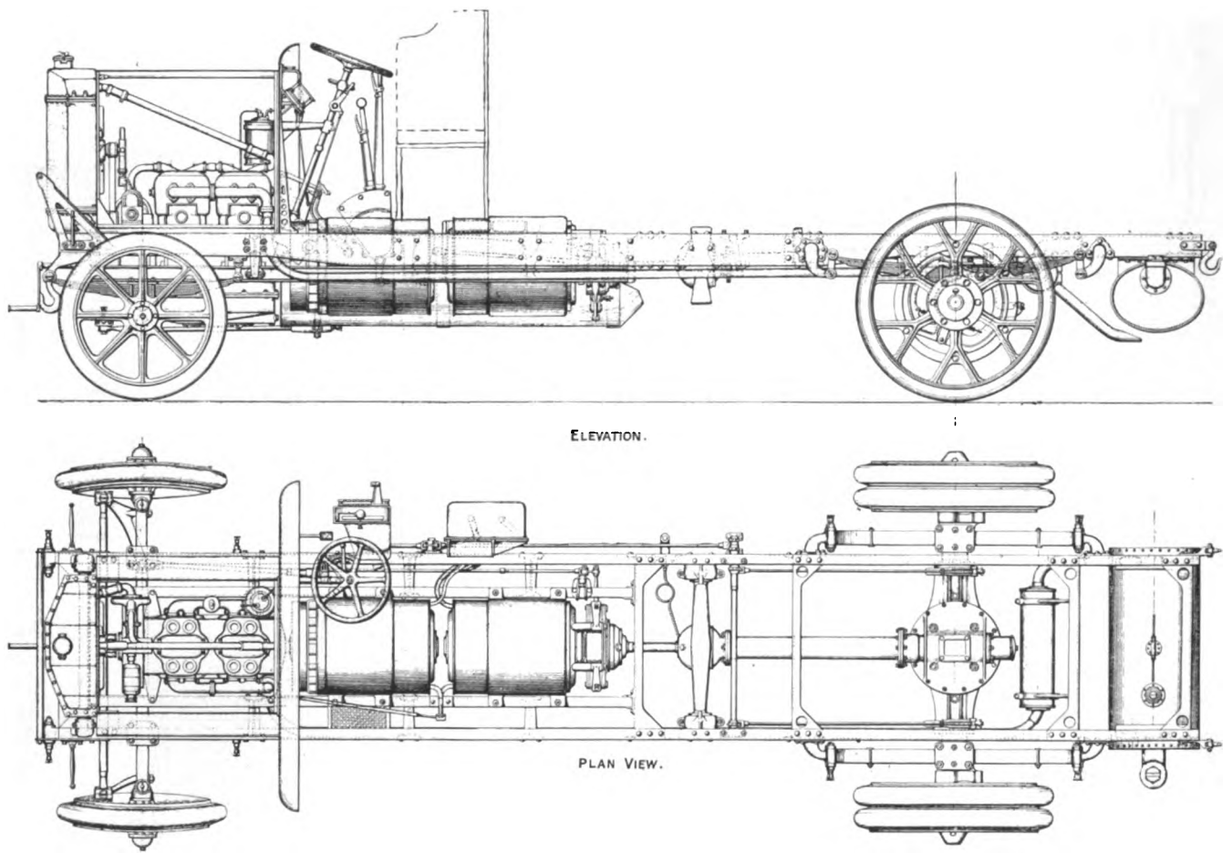

Fig. 6.—Plan and Elevation of Stevens Petrol-Electric Vehicle.

Chassis Features—Withdrawable Live Axle.

A special feature in the design of the chassis, shown in Fig. 6, is the thrust cross member. This is mounted upon rubber-enclosed trunnions, which take all thrust and torque loads, and on that account it is claimed to be much superior to the usual rigid arrangement that allows of no flexibility. The drive is transmitted through a large spherical head, which permits of a perfectly free movement. The torque tube, of large diameter, acts also as a radius rod connecting the ball-head with the rear axle and completely enclosing the propeller shaft. The universal joints between the electric motor shaft and the torque ball are of the ring type, and fitted with bronze bushes of ample size.

Between the engine and generator a flexible coupling is fitted. This is made up of a number of discs of a flexible material, in which rubber enters to a considerable extent. These are cut radially in order that they may be placed in position, the cuts being set at an angle of 120° with each other on the coupling pins. When bolted together, these discs have been found to form an ideal coupling.

A notable feature in the Stevens chassis is the back axle (Figs. 7, 8 and 9). This is the well-known "Dennis" unit, which has earned a well-deserved reputation in all fields of industrial traction. It will be seen the live axle is contained in a steel casing, which carries the weight of the vehicle, the power being transmitted through the specially high efficient worm gearing.

Accessibility is a strong point in the design of this unit. The top cover of the steel casing can be easily removed without taking down the axle. When removed it takes with it the worm, worm gear, and differential gear, while the live axles themselves can be withdrawn without removing the wheels or jacking up the chassis. An oil filler is fitted at the back of the axle casing in an accessible position, so that the oil level can be readily ascertained.

The rear wheels run on hardened and ground bearings fitted with gun-metal floating bushes of the War Office standard pattern. The foot brake is of the contracting type, of large diameter with ample area of wearing surface. It is placed behind the electric motor. The hand brake is of the expanding compensated type, operated by the movement of cams, and is readily adjustable.

The electrical transmission acts as a sprag automatically, and serves effectually to prevent the vehicle from running backwards, except at slow speed, if unexpectedly brought to a standstill without the brakes being applied while negotiating a steep gradient. In this connection it is of interest to note that the test to which subvention vehicles are submitted include the climbing of gradients of one in six fully ladened.

Special attention has been paid to the springing of the Stevens chassis. The springs are well proportioned, and large pins are fitted, while greasers are provided at all points where lubrication is an advantage. Special volute auxiliary springs are fitted to the front axle.

The steering gear is of the Ackermann type, operated by means of a heavy worm and sector, fully enclosed, and giving a large steering lock. The steering connections have spring-loaded ball joints at either end. The front axle is of special section, with ball thrust bearings to the steering heads, allowing of remarkably easy steering.

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MINUTE STANDARDISATION—MOBILE CONSTRUCTIVE SYSTEM.

The chassis frame is of pressed steel of channel section with cross members of the same section. The engine and electrical equipment are carried upon an underframe, the whole being protected from mud and dust by an undershield of non-rusting sheet steel extending from the engine to the rear of the electric motor. A free ground

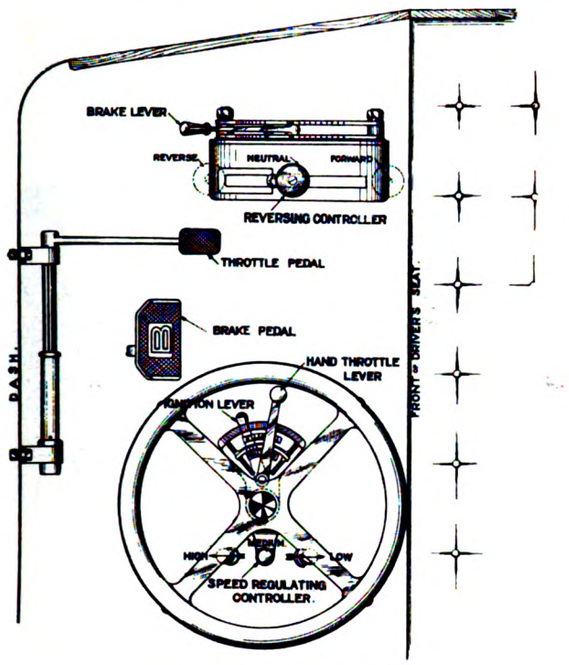
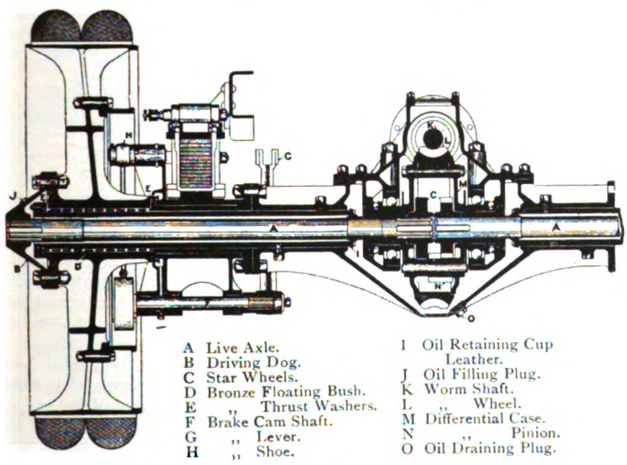


Fig. 4.—Plan of Controls.

clearance of 11½ inches is given, a point of considerable importance in Colonial service.

As already stated, the whole of the possible output of the Stevens vehicles has been hitherto taken by the Ministry of Munitions for the various fighting forces, so that it has been impossible for them to be offered to the public. With the completion of the orders now in hand, however, the company will be in a position to give prompt delivery to intending purchasers. The arrangements for manufacture are such that large numbers can be quickly assembled and



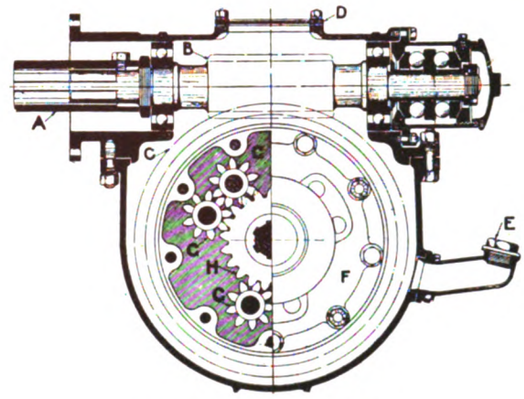
A Live Axle.
B Driving Dog.
C Star Wheels.
D Bronze Floating Bush.
E ,, Thrust Washers.
F Brake Cam Shaft.
G ,, Lever.
H ,, Shoe.
I Oil Retaining Cup Leather.
J Oil Filling Plug.
K Worm Shaft.
L ,, Wheel.
M Differential Case.
N ,, Pinion.
O Oil Draining Plug.

Fig. 7.—Back Axle, General Arrangement.

passed through the exhaustive tests afore-mentioned. All parts being standardised, spares are readily obtainable; even the most minute part has its registered number and figures in the spare part catalogue, which is complete in all details.

A good idea of the method of assembling the Stevens chassis was gathered from our representative's inspection. In one of the bays of the erecting shop were a large number of frames, having been passed from the drilling jigs, where all the holes are drilled by a method which ensures absolute accuracy and greatly facilitates the subsequent erection of the chassis as it passes through the various stages. Many of these frames had their hangers and springs mounted ready to be dropped by the travelling hoist into position upon the axles. A number of generators and motors, together with parts of the equipment, were also assembled here prior to being transferred to the particular spot from which they are placed in position in the chassis.

In a shop of great length and breadth a string of chassis in various conditions of assembly were seen. The wheels having been



A Propeller Shaft Coupling Sleeve.
B Nickel Steel Worm Shaft.
C Bronze Worm Wheel.
D Inspection Cover.
E Oil Filler.
F Differential Case.
G ,, ,, Pinions.
H ,, ,, Wheel.

Fig. 8.—Back Axle showing Differential.

mounted the chassis is moved along the line in easy stages, at each of which one or other of the component parts is placed into position, until finally the completed chassis is moved away under its own power to undergo the tests. In an adjoining shop were a number of such machines, and also one which, having completed the test, had been fitted with the War Office standard body.

In explaining the method of assembling the chassis to our representative, Mr. Stevens referred to the fact that whereas only a few men could work at the same chassis when stationary without interfering with one another, it had been found that by the mobile system a large number could be employed preparing the units of the equip-

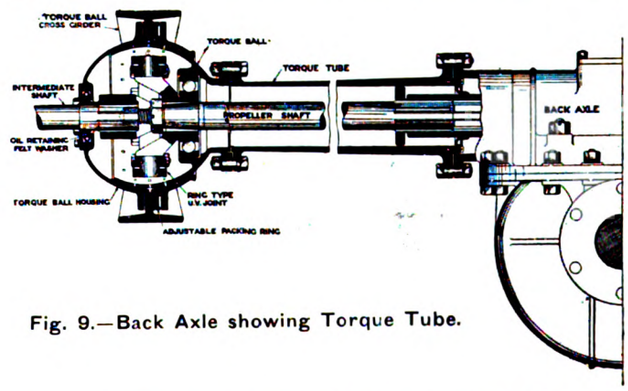


Fig. 9.—Back Axle showing Torque Tube.

ment, and by means of the travelling hoist place them in position in a remarkably short space of time, and so accelerate the output to a very considerable extent. On the occasion of our representative's visit he counted 35 petrol-electric machines in various stages of completion, all of which were destined for the Ministry of Munitions. Judging by the large stock of parts which were to be seen in the capacious store department, however, we shall expect shortly to see the "Stevens" vehicles doing useful work in a variety of public and industrial services.

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MOTOR TRAFFIC

TROLLEYBUS OR MOTORBUS?

CONTRIBUTED BY AN ENGINEER.

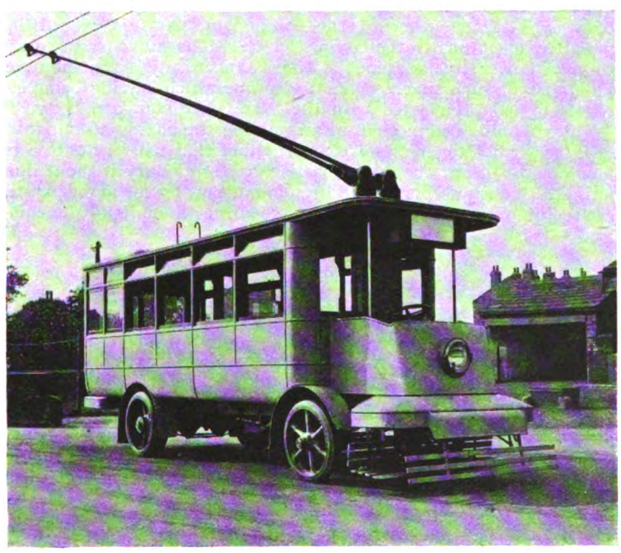
The end of the war quickens into new life all the projected extensions of street traction services and the proposed new installations which have lain dormant for more than four years. Numerous and important as these lines formerly appeared, they constitute but the advance guard of the great array of projects that are now being formulated; for the summons to national reconstruction imposes on all concerned the obligation to survey the traffic requirements of the community with a far wider vision than heretofore, and calls insistently for innumerable additions to our present inadequate communications.

Few new routes were foreseen before the war in terms of rails and tramcars. Capital outlay and maintenance on the one hand, unavoidable interference with and by all other traffic on the other, had already sounded the death-knell of the rail-bound vehicle elsewhere than on the broad main arteries of urban travel and to meet such special conditions as the inter-connection of the tramway systems in adjacent towns. Nor, in the writer's opinion, will the after-effects of the war tend otherwise than to confirm and emphasise the verdict. Furthermore, it is being recognised as better policy to employ cars of moderate seating capacity, and to increase the frequency of service during rush hours, rather than to operate large cars which remain half empty during a great portion of the day

It may therefore be regarded as a foregone conclusion that some form of rail-free vehicle is contemplated for a great majority of the routes which will be equipped for passenger and goods service in the near future. But there is perhaps as yet less general agreement as to the type of rail-free vehicle that will be employed, or in other words as to the motive power by which it will be propelled.

Mechanically-operated rail-free vehicles are a comparatively modern innovation, and owe their existence largely to the development of the internal combustion engine. For this reason a rail-free vehicle and a petrol motorbus or lorry are to many minds almost synonymous terms, and it is apt to be overlooked that the relative merits of rail-bound and rail-free vehicles and the relative merits of various methods of propulsion are two distinct questions.

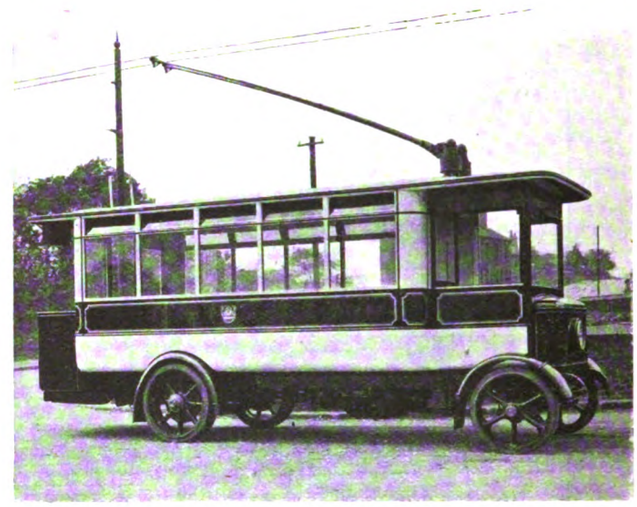
To avoid this confusion of ideas and obtain a clearer conception of the respective advantages of possible alternative methods of



A Trolleybus at Shanghai.

propulsion—electric on the one hand, steam or petrol on the other—it is desirable to consider and analyse the practice of rail-bound traffic, which has been in existence for a far longer time and has not been restricted to only one line of development. It will then at once be observed that the tendency, and to a large extent already the practice, of rail-bound traffic is towards steam propulsion for long and uninterrupted journeys and electric drive for shorter and intermittent services, but that internal combustion engines are nowhere to be found working either express trains or goods trains, or suburban traffic or tramways, or in fact any kind of rail-bound service at all. Even more significant is it that the more nearly the conditions of rail-bound traffic approach those of rail-free services, the more pronounced is the predominance of electricity, which is steadily superseding steam on suburban railways, and has long since ousted every competitor from tramways.

So remarkable a phenomenon is evidently not explicable by minor or secondary considerations, but must be due to some quality



Type of Ramsbottom Trolleybus.

inherent in electric propulsion, which makes it, for intermittent services, notably and indisputably superior to all other known methods. This quality is not far to seek. The essence of satisfactory intermittent service is quick acceleration, and the essence of quick acceleration is the ability to produce and apply instantaneously a tractive effort far in excess of normal running requirements.

This feature is inherent in the combination series motor and central station to a degree unapproached by any other motive power. For whereas the highest rate of acceleration attainable by its nearest competitor, the steam engine, falls far short of the requirements of intermittent passenger service, the only limit to the acceleration of the electrically-propelled vehicle is the physical comfort of its passengers. When, moreover, it is considered that such accelerative power as the steam engine possesses is solely attributable to its large overload capacity and high starting torque, the failure of the internal combustion engine to secure even a footing on rail-bound vehicles appears to be the logical and rational consequence of its having no starting torque and a relatively small overload capacity.

The result of this digression has therefore been to disclose that, for comparable services, the best method of propulsion is universal on rail-bound vehicles, but only the third best on the vast majority of those which are rail-free. It is therefore of interest to investigate the causes which retarded the development of rail-free vehicles propelled by steam or electric power, and enabled the internal combustion engine, in spite of its inherent disabilities, to be first in the field, and thereby to obtain a long lead over its rivals.

The obstacle which has chiefly impeded the progress of steam-driven cars is that steam plant is not easily adapted to the small units and light weights which are essential requirements in rail-free vehicles. Electric propulsion, on the other hand, failed to satisfy an entirely different but equally vital condition—mobility. A motorbus is self-contained, and is therefore perfectly mobile. It can follow any route at will, it can pass and be passed by other traffic to an unlimited extent. But the primitive type of trolleybus was compelled to travel in close proximity to the centre line of the trolley wires, and the privilege of deviating therefrom freely and without risk of unshipping the trolley wheels was obtainable only at the price of excessive and injurious upward pressure on the wires. In a few installations mobility was attained by the use of an overrunning trolley, connected to the vehicle by a flexible cable, but this device, long since tried and rejected on tramways, is open to two serious objections—it cannot be adapted to any reliable design of overhead switch or crossing, and it makes it impossible for the trolleybus to be used in conjunction with, and as an adjunct to, existing tramways.

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The lack of mobility from which the trolleybus formerly suffered was overcome by the balanced under-running trolley, which enables the vehicle to deviate at least 15 feet on either side of the centre line of the route without the assistance of any abnormal upward pressure on the trolley wheels, and without giving rise to any tendency for them to leave the wires. Equipped with this device the trolleybus enjoys absolute freedom of manœuvre on any road, it can pass and be passed by other traffic, and it has all the flexibility which distinguishes rail-free vehicles from rail-bound.

It may, indeed, be contended that a trolleybus does not possess that absolute and unqualified mobility which belongs only to a vehicle with self-contained motive power. Unlimited mobility is not, however, a characteristic of material value in public passenger service except in comparatively infrequent and exceptional circumstances. The absence of any physical disability notwithstanding, motorbuses do not in fact career indiscriminately along every accessible road and street. The public service in which they are engaged rivets on them inexorably the time table and the map. They are rail-free indeed, but no more than tramcars are they route-free. From the same considerations it follows that the physical bond which ties the trolleybus to a defined route merely attaches to it a limitation which would in any case be imposed as exceptional severity. Motorbuses achieved their greatest successes on London streets, which on the one hand, with their well-paved surfaces, reduced the cost of maintenance to a minimum, and with their enormous traffic ensured on the other hand a revenue sufficient to cover maximum working expenses. Many a provincial installation has found to its cost that the unique conditions of the metropolis are a wholly illusory basis for estimates of net revenue in other cities. But trolleybus services have from the outset been conducted, and have been financially successful, in provincial districts with populations too small to provide more than a modest revenue, and over road surfaces which make the most searching test of their mechanical strength and durability.

Two instances may be quoted. In one installation, which for several years past has been serving a colliery district and using a rough country road, the cost of maintenance, exclusive of tire renewals, is one penny per car-mile. In the other, trolleybuses, running from 120 to 170 miles daily over indifferent roads and carrying at times 60 and even 70 passengers, are costing no more for maintenance to-day than when first put into commission over seven years ago.

Against the superior economy and reliability of the trolleybus there may be, and often is, urged the capital outlay on trolley wires

A Trolleybus Junction at Bloemfontein.

a primary condition of every organised system of transportation. For the purposes therefore of public passenger service, motorbus and trolleybus are both equally rail-free, both equally route-bound.

Observing, then, that neither type of vehicle has, in respect of mobility, any useful advantage over the other, and bearing in mind that for similar rail-bound services electric propulsion has swept all competitors from its path, it may safely be concluded that the trolleybus with balanced under-running trolley is the type of vehicle best suited to the routes that are now awaiting equipment for passenger service.

To this conclusion experience of existing trolleybus installations lends powerful support, for the advantages which have given electric propulsion its pre-eminent position in intermittent rail-bound traffic have been reproduced in the rail-free model. Accelerative power has enabled a high average speed to be maintained, and in addition the following characteristics have been observed—much lower working costs, more reliable and comfortable service, longer life, greater annual mileage, ability to carry without distress as many passengers as can find standing room, and the power to climb with ease hills which no motorbus could surmount.

Moreover, it has to be borne in mind that the records of the trolleybus are derived as a rule from service under conditions of This outlay is, however, offset, and in most cases more than offset, by the resultant saving in the cost of motive power alone. For even if the price of petrol reverts to its pre-war basis, it is only under most favourable conditions that motorbuses will be operated at a cost as low as 2¼d. or 3d. per car-mile for fuel and lubricating oils. On the other hand, it has been well established that the energy consumed by a trolleybus, including line losses, never exceeds one kilowatt-hour per car-mile, and although the price of electric power varies widely, being anything from ½d. to 1½d. per kilowatt-hour, yet it is easy to see that the saving effected by the trolleybus in this one item alone is never less than 1½d. per car-mile. Now on a route with a service of only one car in each direction every half-hour, a saving of 1½d. per car-mile amounts to no less than £150 per annum per mile of route—a very ample allowance for maintenance and interest charges on the cost of the overhead line. The denser the traffic the more pronounced is the economy of electric motive power, and it is only in the case of very infrequent services that the trolley wires would not pay for themselves.

If, then, all the items contributory to the cost of maintaining a service of trolleybuses or motorbuses are taken into review it is found that

(1) Electric motive power is cheaper than petrol by an amount

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which compensates for the extra capital outlay on trolley wires, and leaves a margin of profit dependent on the density of the traffic.

(2) The cost of maintaining and repairing trolleybuses does not exceed a maximum of 1d. per car-mile, whereas the corresponding outlay on motorbuses is never less than twice as much, and is far higher under the conditions of service to which trolleybuses are usually subjected.

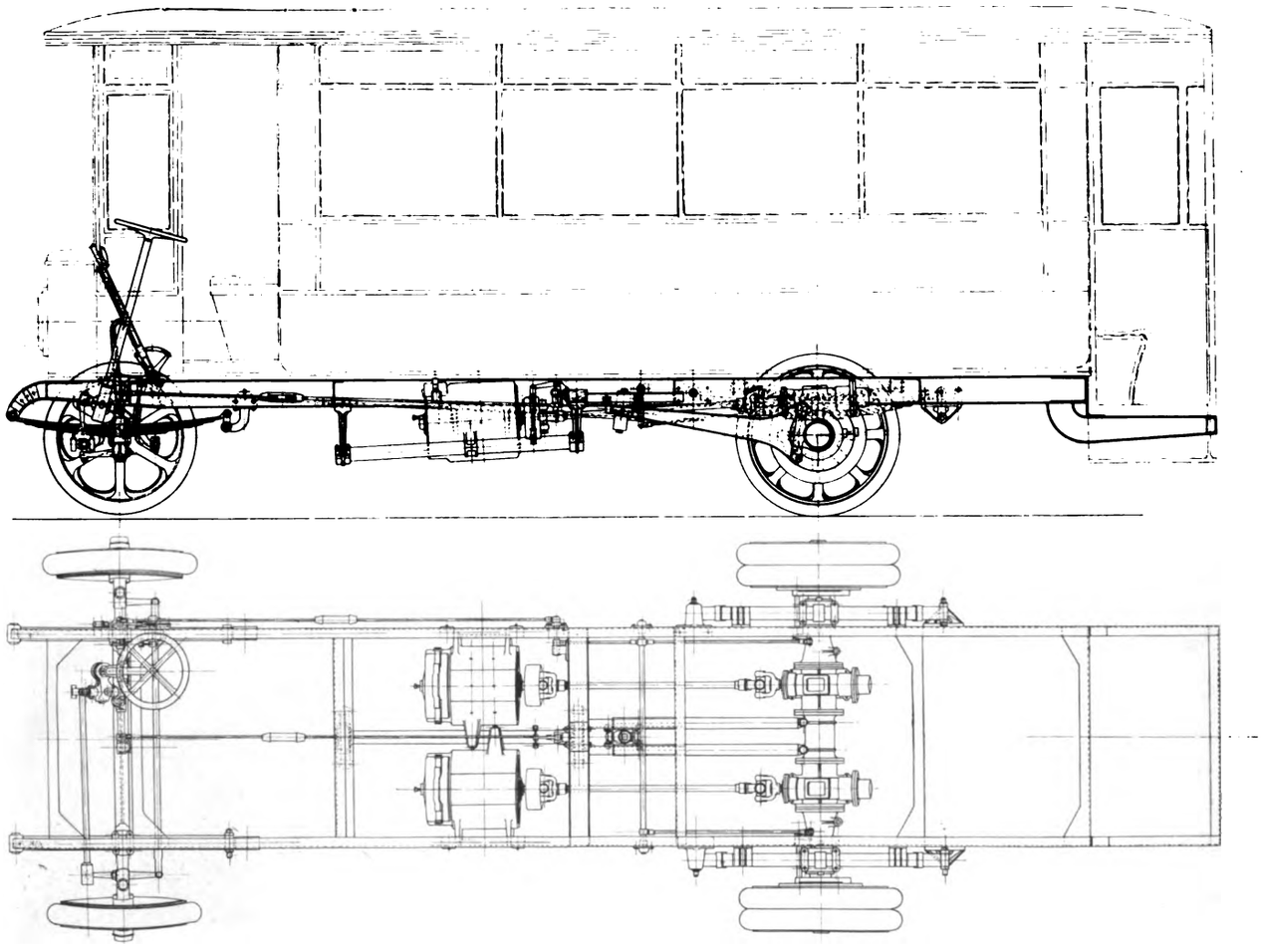
(3) Wages of motormen and conductors and renewal of rubber tires are items of expenditure which are appreciably the same for both systems.

(4) The relative costs of maintaining the two types of vehicle are reflected in the respective rates of depreciation, for whereas a period of five to seven years is the limit of useful life of a motorbus, experience shows that a life of 10 or 15 years is a reasonable expectation for trolleybuses.

When the innate suitability of electric power for traction purposes, and more especially for intermittent street services, is compared with the essential unsuitability of internal combustion engines for any other than continuous and sustained operation under uniform conditions, the degree of perfection to which motorbuses have attained constitutes an unparalleled triumph of engineering skill and persistence over extraordinary difficulties. It does not detract from this remarkable achievement that trolleybuses are enabled, by virtue of their motive power, to exhibit such solid and substantial advantages as would, in the majority of installations, spell the difference between financial success and failure, and that the only valid counterclaim on behalf of motorbuses is that they are able to leave their appointed route and wander into by-ways.

Goods traffic is neither so rigidly route-bound nor so dependent on quick acceleration as passenger service, and although the superiority of electrically driven lorries and tractors may for this reason not be so immediately obvious, yet it is all important from the standpoint of lowest working costs. Inasmuch, then, as economical operation will be an important consideration for all proposed new freight routes, and is to be regarded as the determining factor in agricultural districts, it must be recognised that some of the fundamental and most urgent transportation measures of the reconstruction programme will depend on electric haulage for their realisation.

It may not be out of place to add a few general remarks on the design of electric road vehicles. The notable success that has already attended their use was achieved with designs which included many features more or less standardised in motorbus practice. Some of these features, though indispensable or unavoidable in other mechanically-propelled vehicles, are superfluous in connection with the simpler electric motor drive. It may therefore be anticipated that the electrically-driven rail-free vehicle of the future—the trolleybus designed to take full advantage of the manifold potentialities of electric power—will be as free from the trammels of petrol practice as the motor-car of to-day is from the shadowy equine spectre whose ghostly company haunted the earliest examples of "horseless carriages."



A Trolleybus Chassis.

THE RULE OF THE ROAD.

Lord Montagu of Beaulieu has suggested that the Peace Conference should consider the question of "making the roadways safe for democracy" by instituting a uniform rule of the road for Europe. The suggestion that vehicles in this country should keep to the right (as in most Continental countries) instead of the left side is rendered more important in view of the fact that many accidents to foot passengers would be averted, especially in cases of running down when stepping off the pavement. In Lord Montagu's opinion, an alteration of the rule would also avert considerable delays to tramway cars and omnibuses, due to the ignorance or neglect of the rule of the road. General observance of the rule of the road might avert some costly street widenings.

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OMNIBUSES TO AUGMENT TRAMWAY FACILITIES.

Liverpool Tramways Committee have sanctioned a scheme for assisting the electric tramway service by means of one hundred motor omnibuses. The scheme has been proposed in view of the very heavy demands for passenger transport now experienced in the city. To increase the number of tramway cars is out of the question for a long time, and the situation can be quickly eased by instituting a service of omnibuses. At the meeting of the committee, Alderman E. Russell-Taylor said that during the past four and a half years it had been impossible to obtain new rolling stock or to maintain the old in a thoroughly efficient state of repair, although during the period referred to the city passenger traffic increased by several millions as compared with pre-war years. The existing rolling stock had proved altogether inadequate to meet the extraordinary traffic requirements, the cars being over-crowded from time to time, and the main arteries and terminal points being much congested. It is proposed that the omnibuses shall keep as far as possible from the main tramway thoroughfares, so as to avoid congestion. On certain parts of their journeys they will run at high speed, and journeys will, it is stated, be completed in shorter times than by the electric cars. Numerous routes will be covered and the service is expected to be running in a few months' time.

It is proposed to run motor omnibuses from certain termini of the Portsmouth tramways through various parts of the town and districts not served by the tramways.

The Corporation of Birkenhead have decided to "experiment" with motor omnibuses. It will be recalled that about ten years ago the Corporation, by an action at law, compelled the Mersey Railway Company to withdraw their omnibuses from the streets. Now it is thought that omnibuses will form a useful adjunct to the tramway system.

Stockton Corporation have decided to seek Parliamentary powers to construct tramways from the existing lines in the borough to Port Clarence, to purchase the motor-omnibus undertaking of the Imperial Tramways Company, and to run motor omnibuses in the borough and also to Port Clarence and Greatham Creek.

The Middlesbrough Town Council have decided to promote a Bill with respect to the acquisition, construction, and working of tramways, trolley vehicles, and motor omnibuses.

NO TAX ON BENZOL.

Following representations by the National Council of the Commercial Motor Users' Association, it has been notified by the Board of Customs and Excise that the contemplated imposition of a duty of 6d. a gallon on home-produced benzol, which tax was to have come into force on January 1, is suspended.

The Association, acting in concert with associated transport organisations of employers and labour, are hoping to secure the total withdrawal of the proposed tax on this important home-produced motor fuel.

NATIONAL TRANSPORT.

It has been stated that before the Government went to the country, Sir Eric Geddes was deputed, in consultation with Sir Albert Stanley, to draw up a scheme of national transport services in which a system of State railways would be linked up with canals, motor transport, and aerial and sea services, not necessarily publicly owned. It is rumoured that Sir E. Geddes will be the director of a new department of inland, sea, and overhead transport.

RAILWAY ATTITUDE TO MOTOR TRACTION.—In speaking recently of the eagerness of organised railway employees to consider the railway nationalisation project of the Government, Mr. C. T. Cramp, president of the National Union of Railwaymen, stated that in his election campaign at Middlesbrough he made a great point of the need to provide good motor roads through the undeveloped parts of the country to assist agriculture and industry, the roads to be supplementary and not competitive with the railways.

SOLID TIRE GUARANTEE.—The Macintosh and Challiner solid tires having established a record for accomplishing a mileage in excess of the guarantee of 10,000 miles, the Shrewsbury S.T. and Challiner Tyre Company, Limited, have decided to guarantee Macintosh and Challiner solid tires supplied on and after January 1, 1919, for 12,000 miles, subject to the usual tire guarantee conditions. In the case of steam wagons with trailers attached it may be advisable to point out that the existing guarantee conditions allowing for "a limited and reduced guarantee not exceeding 7,000 miles" will still apply.

DISABLED SERVICE MEN AS DRIVERS.

The Home Secretary announced on December 22 that as many applications are likely to be received from partially disabled sailors and soldiers for licences to drive public motor vehicles, he has decided to reappoint the committee which considered the subject in 1916. The committee have been asked to review the conclusions then arrived at, and to report whether they should be reaffirmed or modified.

The members of the committee are:—Mr. F. L. D. Elliott, Assistant-Commissioner of Police (chairman); Mr. H. E. Blain, representing the London General Omnibus Company; Mr. C. W. Bowerman; Major A. Tudor Craig, C.B.E., secretary, Soldiers' and Sailors' Help Society; Mr. J. W. Orde, secretary, Royal Automobile Club; Mr. R. J. Simpson, Local Government Board; Mr. A. Smith, of the London and Provincial Union of Licensed Vehicle Workers; and Col. H. J. Waring, M.S., President of the Royal College of Surgeons.

There are two alterations in the composition of the committee. Mr. Blain, operating superintendent of the London General Omnibus Company and Underground Railways, takes the place of Sir Albert Stanley, the late managing director of those undertakings, and now President of the Board of Trade, and Colonel Waring is serving instead of Sir Frederick Eve, F.R.C.S.

The secretary of the committee is Mr. H. A. Tripp, and any communications should be addressed to him at the Metropolitan Police Office, New Scotland Yard, London, S.W.1.

In their report, issued in the second half of the year 1916, the committee dealt thoroughly with the main categories of physical disability from which men presenting themselves for licences might be expected to suffer. The report assumes in each case that the lost limb has been replaced by a suitable artificial one, but it is pointed out that even the most perfectly adapted artificial limb is liable to fracture, and this, if happening at a moment of emergency, might produce serious results. The committee recommended that men suffering from the loss of an eye, a hand, an arm, a foot, or a leg should not receive licences. Apart from the risks attaching to such disabilities, the committee were influenced by the considerations that although every licensed driver has to pass a strict medical examination, the number of deaths caused by vehicles in London has continued to rise, and they held that the logical outcome of lowering the physical standard for drivers would be an increase of street casualties. The committee remark that the great majority of omnibus and tramcar drivers who enlisted became drivers of mechanical transport vehicles, and it is assumed that the loss among drivers of this class will not be abnormally heavy.

UNDERGROUND OPERATING EFFICIENCY MEETINGS.

The third meeting of the fourth year of Operating Department Efficiency Meetings was held on December 10, at the L.G.O.C. Training School, Milman's Street, Chelsea, Mr. H. E. Blain, Operating Manager, presiding over an attendance of over 350 members of the administrative and control staffs of the allied companies.

Papers on "Problems of My Official Life" were read by Mr. W. H. Parsons, chief clerk, Season Ticket Office, District Railway; Miss B. S. Thomas, chief woman supervisor, Underground Railways and L.G.O.C.; Mr. W. Patient, station inspector, Victoria, District Railway; Mr. J. E. Wilkinson, travelling ticket inspector, London Electric Railway; Mr. A. J. Littlewood, beat inspector, L.G.O.C.; Mr. M. J. Embray, operating foreman, Leyton Garage, L.G.O.C.; and Mr. D. G. Squirrel, 'bus mess-room steward, Hendon Garage.

The evening proved one of the most interesting of the whole series, owing to the varied character of the papers. The underlying note of personal interest in the work of transportation and the supreme desire to solve, in the most satisfactory manner, the daily problems it presented, was an evidence of the spirit in which the efficiency of the whole organisation has been built up.

A brisk discussion was opened by Mr. G. C. Ravening, chief divisional inspector, Central London Railway, and Mr. A. Robbshaw, chief 'bus operating foreman, Willesden Garage, and continued by Messrs. Bird, Newman, Savidge, and Cromack, considerations of time alone preventing many others from taking part.

A vote of thanks was accorded to the readers of the papers on the motion of Mr. C. J. Spencer, the newly appointed manager of the Allied Tramways Companies, seconded by Mr. Murray Griffiths, Director of the District Railway.

The next paper of the series will be "A Day in a Controller's Office"—(*a*) District Railway, (*b*) Tubes, and (*c*) L.G.O.C.

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MOTOR TRAFFIC

MOTOR TRAFFIC NOTES.

LEYLAND MOTORS LIMITED, in December, received the sanction of the Treasury to the issue of bonus shares at the rate of 50 per cent. full paid and free of tax.

NO RESTRICTIONS ON TRAFFIC IN FRANCE.—The French Government ordered the removal of the restrictions on the use of paraffin and petrol as from January 1.

USE OF PLEASURE OMNIBUSES.—The Horsing Order No. 2, 1916, prohibiting the use of omnibuses and chars-a-banc for pleasure purposes, was withdrawn on December 16.

THE ECONOMY OF MOTOR SWEEPERS.—It is reported that the two Laffley motor sweepers purchased by Lambeth Borough Council in 1915 have effected a very considerable economy as compared with sweeping the streets by horse-drawn brooms.

GAS TRACTION PRIZE.—The closing date for receiving entries for the Automobile Association £1,000 competition for the best method of using coal gas for propelling motor cars has been postponed at the special desire of the Gas Traction Committee, until January 31.

ARMY LORRIES FOR CHRISTMAS MAILS.—Notwithstanding that there was a considerable falling off in the Christmas postal business in London, the authorities were glad to have the loan of 170 three-ton lorries from the War Office. The services of the drivers were lent with the vehicles.

MOTOR TRANSPORT IN THE JUNGLE.—In his report on the campaign in German East Africa, General van Deventer states that motor transport could only be intermittent owing to the jungle, especially during the wet season. Long stretches of track, he adds, were more suitable for boats than for motor transport.

THE INSTITUTION OF AUTOMOBILE ENGINEERS.—The fourth meeting of the session of the Institution of Automobile Engineers was held on Wednesday, January 8, at the Royal Society of Arts, John Street, Adelphi, when Mr. L. H. Pomeroy read a paper on "Influence of Valve Lift and Combusion Chamber Design on Consumption."

ELECTRIC TRUCKS FOR RAILWAY COMPANIES.—The cartage department of the Great Northern, Great Central, and Great Eastern Railways have placed an order for five 30-cwt. battery trucks with Messrs. Richard Garrett and Sons, Limited, of Leiston, Suffolk. The Lancashire and Yorkshire Railway have ordered two 2½-ton vehicles from the same firm.

ROAD DAMAGE BY GOVERNMENT TRAFFIC.—Through the Joint Roads Committee appointed by the War Office, the Treasury have notified that the Government will be prepared to pay compensation for road damage caused by extraordinary traffic in connection with the haulage of home grown timber, provided the timber has been required for Government purposes.

BRITISH MAGNETOS.—As a proof of the great stride British manufacturers are making in the production of magnetos, we note with satisfaction that Messrs. C. A. Vandervell and Company's output for October alone was no less than 3,500. The C.A.V. magneto figured largely on the motor cycles of our despatch riders on all fronts during the war, and met with their highest commendation.

MOTORS IN THE OCCUPIED GERMAN AREA.—Great numbers of armoured cars and machine gun cars have accompanied the forces representative of the French, British, and American armies in the areas that each is occupying in Germany. The mechanical transport corps is also well represented. British road construction battalions under Brigadier-General Maybury had a great deal of work to do in repairing roads destroyed by the Germans.

JOINT INDUSTRIAL COUNCIL FOR THE TRANSPORT INDUSTRY.—The Motor Transport Employers' Federation is interesting itself in the establishment of a Joint Industrial Council of the Transport Industry. Any owner of a goods carrying commercial motor vehicle is eligible. A copy of the prospectus can be obtained from Mr. F. J. Bristow, general manager of the association, 83, Pall Mall, London, S.W.1. Major-General S. S. Long, C.B., of Lever Brothers, Limited, is chairman of the committee.

PASSENGER TRANSPORT AT WORTHING.—Concurrently with the removal of the restrictions on the use of motor vehicles, the Southdown Motor Services, Limited, have arranged to provide additional facilities. The company have acquired an omnibus undertaking hitherto operated in the town, and besides giving an improved local service they will increase their services in West Sussex. For a decade these services have provided facilities which were beyond the power of the railway company to give.

BENZOL PRODUCTION.—In view of figures appearing in a report of the Manchester Gas Committee it would be interesting to make a computation of the quantity of benzol produced for war service by the gasworks of the country. Between January, 1916, and November, 1918, the various works controlled by the Manchester authority produced 1,786,219 gallons of crude benzol, from which 803,799 gallons of benzol were obtained, together with 267,933 gallons of toluol and 87,311 gallons of solvent naphtha.

MUD SPLASHING BY HEAVY VEHICLES.—Owing to complaints of heavy vehicles splashing mud on the clothes of pedestrians, the Watch Committee of Bradford recently circularised the owners of vehicles on the matter. Efforts were made earlier to deal with the matter by obtaining a new by-law, but at the time that course was found to be impossible. The Watch Committee propose to go into the subject again, and their chairman has expressed the hope that now the war is over labour will be forthcoming to keep the streets cleaner.

MOTOR VEHICLES FOR MUNICIPALITIES.

CHESTER-LE-STREET COUNCIL have obtained an additional motor wagon.

GLASGOW CORPORATION have purchased a Sunbeam car for £500 for use as an ambulance.

WEST RIDING SPECIAL CONSTABULARY are collecting £1,000 for the purchase of a motor ambulance.

KENSINGTON COUNCIL have obtained a De Dion car for the use of the superintendent of outdoor work.

BOOTLE COUNCIL have decided to form a motor department to undertake their motor transport and cartage work in every department with the exception of the fire brigade.

LUTON COUNCIL have asked their engineer to report as to the advisability of collecting house refuse by motor van, and two members were appointed to accompany him to inspect suitable vehicles.

SOUTHEND COUNCIL have received a report as to the use of a movable floor for a motor wagon in order to expedite loading and unloading. A deputation was appointed to inspect vehicles so equipped and to report thereon.

WALLASEY TRAMWAYS COMMITTEE propose to purchase a number of new tramway cars and ten motor omnibuses. The idea is to afford additional facilities and to relieve the tramways by using omnibuses for passengers travelling to points beyond the tramway termini.

NEW OMNIBUSES FOR EASTBOURNE.—Regarding the motor omnibuses ordered by Eastbourne Corporation, Messrs. Leyland Motors, Limited, promise delivery as early as possible, but point out that difficulties exist at present in getting the necessary material for the lighter type of omnibus chassis.

LOCAL AUTHORITIES will be interested to learn that the Austin Motor Company, of Northfield, Birmingham, have a number of 2 to 3-ton lorries now released for civil use. The company announce that Messrs. R. M. Wright and Company, of Lincoln, have taken up the sole representation for Lincolnshire.

LAMBETH BOROUGH COUNCIL have appointed a committee to consider the advisability of substituting motor vehicles for horses, and to report as to what motor equipment would be required. This course was taken on the motion of Councillor J. Mitchell, who is the controller of the London Underground and General Omnibus Group.

BOLTON CORPORATION, having considered the question of provision of a motor for the use of the police department, whenever required, the Fire Brigade Committee have asked the General Purposes Committee to consider the provision of motor vehicles, and the establishment of a municipal garage for the purpose of providing a motor service for the use of the various departments of the Corporation.

COUNTY BOROUGH OF WALLASEY.

ELECTRIC TRAMCARS AND MOTOR OMNIBUSES.

The Tramways Committee is prepared to receive tenders for the supply of ten to twenty Double-Deck Top Covered Tramcars with single trucks and electric equipment complete.

Further particulars as to specification and general conditions may be obtained on application to the Tramways General Manager, Sea View Road, Wallasey.

The Committee does not bind itself to accept the lowest or any tender.

Separate tenders for Tramcars and Motor Omnibuses should be submitted and endorsed outside "Tender for Electric Tramcars" or "Tender for Motor Omnibuses," as the case may be, and reach the undersigned not later than Monday, January 27, 1919.

By Order,
H. W. COOK,
Town Clerk.

Town Hall,
Wallasey.
January 6, 1919.

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THE Tramway & Railway World
WITH MOTOR TRAFFIC SECTION

Founded 1892. LONDON, FEBRUARY 13, 1919. VOL. XLV.

ELECTRIFICATION OF THE MONTREAL TUNNEL ZONE.

A PAPER PRESENTED TO THE AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.

By WILLIAM G. GORDON.

The city of Montreal is divided into two principal levels; the commercial and financial quarter being on a plane only a few feet above high water, and the residential and shopping districts being at a height of about 75 ft. above the river. As the space between Mount Royal and the St. Lawrence River is limited, this district has become very congested. Business has largely forced the residence section up and down the river and around the mountain. The tunnel under Mount Royal was built with the idea of giving the Canadian Northern Railway, which property now belongs to the Dominion Government, an entrance into the heart of the city, and to render available a large area for residential purposes, only a few minutes by train from the main railway terminus.

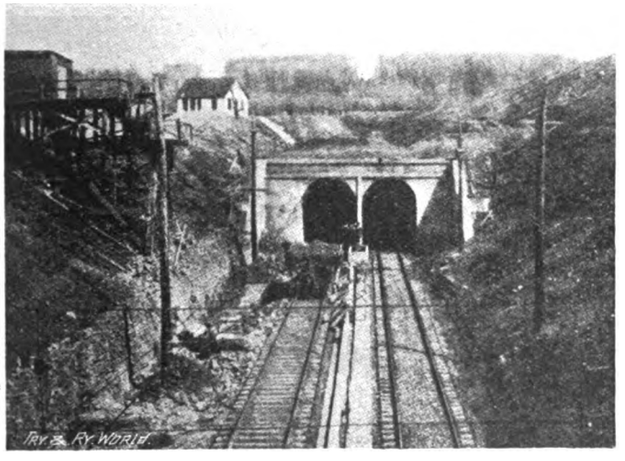

Fig. 1.—West Portal of Montreal Tunnel.

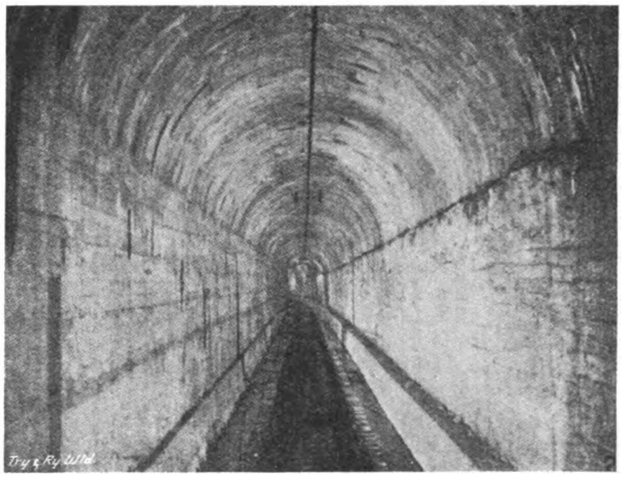

Fig. 2.—A Two-Degree Curve in the Tunnel.

The location of the present terminus is about midway between the two levels, and it is proposed to extend an elevated line, at the same uniform grade, which will connect up with the proposed viaduct on the lines of the Harbour Commission, thus giving direct access to transatlantic steamers and all the harbour facilities. The tunnel as built is 3·1 miles long, and is the shortest line that can be devised to take advantage of the geological formation. The tunnel has a uniform grade of 0·6 per cent. toward the city to insure proper drainage.

In order to meet the various physical conditions, different cross sections were used where hard sound rock, unsound rock and soft ground were encountered respectively. The twin section type of tunnel was adopted for (1) economy in construction, (2) ease and economy in ventilation, and (3) protection and safety in case of derailment or accident. In addition to working from both ends of the tunnel, a shaft was sunk one mile from the West Portal at Maplewood Avenue.

It is of interest to note that when the heading from the West Portal met that being driven from the Maplewood Avenue shaft, the lines checked within 1/16 in. on the alignment, and ¼ in. in grade, and that where the headings from the Maplewood Avenue shaft and that from Dorchester Street met under the highest point of Mount Royal, the error was ¾ in. in alignment and ¼ in. in grade.

The method employed in driving the tunnel was to drive a bottom centre heading about 8 ft. high by 12 ft. wide, as this heading could be driven ahead rapidly without much regard to the character of the ground, and from which the full size excavation could be developed at as many places, simultaneously, as desired. Four drills were used in each heading, supported on a horizontal bar; the drills being operated by compressed air at a pressure of about 100 lb. per sq. in. The break-ups, where the upper part of the tunnel section was excavated to its full width and height, were opened at intervals of from 500 ft. to 800 ft. along the centre bottom heading, the practice being to open up as many of these as necessary to keep up with the heading progress. The compressed air used for operating the drills and other pneumatic machinery was obtained from two plants, one at each

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end of the tunnel, with an aggregate capacity of 11,000 cu. ft. of free air per minute, compressed to 110 lb. per sq. in. The muck from the tunnel was handled by two 10-ton and one 8-ton trolley locomotives, and six 5-ton storage battery locomotives.

The load curve was worked up from the following data :—

TRAIN WEIGHTS AND SPEEDS ASSUMED FOR MONTREAL TERMINAL ELECTRIFICATION.

Class.	Trailing tons.	Speed level.	0·6 per cent. up-grade.	Schedule.
Transcontinental	1,130	37·0	26·5	21·2
Express and local	550	37·5	27·1	21·6
One motor coach	60	50·0	41·5	22·2
Three motor coaches ...	180	50·0	41·5	22·2
Three motor coaches and two trail coaches	260	47·8	34·8	21·8
Freight	1,000	32·5	23·5	—

Power is purchased from the Montreal Light, Heat and Power Company at 63 cycles, 11,000 volts, three-phase. It is delivered to the sub-station by a lead-covered, three-conductor cable carried in a duct through the tunnel, and also by an overhead line to insure continuity of service. The general arrangement and capacity of the switching equipment provides for the later addition of a steam auxiliary plant at the Back River near the Cartierville Yards for extension of the electrification of the main line to Ottawa. There are two motor-generator sets, with provision for a third later. Each of these sets consists of a synchronous motor direct coupled to and on a common bed-plate with two 750 KW., 1,200 volt, d-c. generators, the set running at 600 revolutions per minute. The generators are connected in series, giving 1,500 KW. at 2,400 volts per unit.

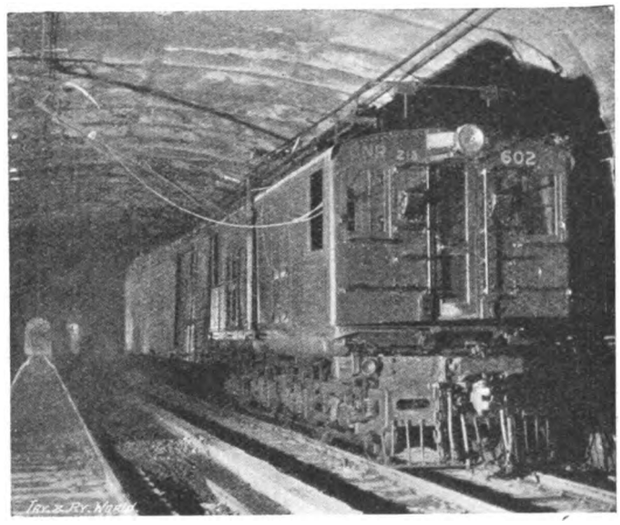

Fig. 3.—Locomotive Pulling in Messenger and Taking Current from Wire over Opposite Track.

The sets have an overload capacity of 200 per cent. for five minutes. The heavy overload capacity of these machines is obtained by the use of a pole-face winding. This winding of tubes and rods through holes near the pole faces is so connected as to directly oppose the armature reaction, thus insuring satisfactory operation up to the heavy overload mentioned. The pole-face windings and the series and commutating field windings are all connected on the ground side of these machines. The shunt fields of the d-c. generators and the synchronous motor fields are arranged for 125-volt excitation. Each of the synchronous motors is started by a three-phase, 11,000 volt compensator. This auto-transformer has one coil per phase with suitable starting taps brought out.

The three exciter sets each consist of a 50 KW. 125-volt d-c. generator driven by an induction motor. The generators are commutating pole type, flat compounded for the specified voltage, and are especially adapted for exciter work and voltage regulator control. A bank of six 100 KW. single-phase transformers supply the induction motors of the exciter sets and miscellaneous station requirements.

All oil switches on the 11,000 volt circuits, except the synchronous motor magnetising and starting switches, are enclosed in masonry cells and have two breaks per pole, each break in a separate tank. These switches have a rupturing capacity of 16,000 arc amperes at 11,000 volts. They are motor operated, and will open automatically on overload, the incoming line switches excepted, either instantaneously or with a time-limit action, as desired. The incoming line switches operate automatically on the reversal of power only. The synchronous motor starting switches are remote-control, solenoid-operated, mounted in cells, and have a rupturing capacity of 2,000 arc amperes at 11,000 volts.

The main switchboard is of three-section panels of natural black slate, 90 in. high. The 2,400 volt direct-current circuit breakers and lever switches are mounted on a panel back of and above the main switchboard. They are operated by insulated handles on the front of the main board, so as to eliminate any possibility of the operator coming in contact with the 2,400 volt circuit. The circuit breakers are mounted between fireproof barriers, and are equipped with powerful magnetic blowouts. The field switches are mounted on a base back of the panels, with the operating handles on the front of the main board.

There are six locomotives in operation. Each locomotive has four axles, with all the weight of the locomotive upon the eight driving wheels. The running gear consists of two four-wheel trucks, articulated with a heavy hinge. The equalisation of the trucks is accomplished by a semi-elliptic leaf spring over each journal box, connected through spring hangers to the frame and to the equaliser bars. The equivalent of a three-point suspension is thus obtained through the side equalisation of one of the trucks and both side and cross equalisation of the other truck.

The friction draft gear is mounted in the end frame casting of the truck. This type of construction restricts the hauling and buffing stresses to the truck side frames and articulated joint, thus relieving the cab and apparatus from the effects of severe shocks. The cab, which is of the box type, is divided into three compartments, the centre compartment for the apparatus, and the two end compartments for the operator. Each operator's compartment is supplied with controller, control switches, ammeter, air brake and pantograph control, air gauges, 2,400 volt cab heater, bell-rope, and control for the whistle and sanders, thus providing the locomotive with complete double end control. The motors are nose-supported in the usual way, and geared to the axle by means of twin gears, each of four-inch face.

The motor equipment consists of four commutating pole motors wound for 1,200 volts, and insulated for 2,400 volts, two of these motors being permanently connected in series for operating on the 2,400 volt trolley circuit. The one-hour rating of each motor is 320 H.P. at 1,200 volts. The motors are designed for forced ventilation, which is obtained by means of a

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blower in the locomotive cab. Either pair of motors may be cut out by a special handle on the change-over switch. The locomotives are geared for a free running speed on tangent level track of approximately 45 miles per hour, with ten points in series and nine points in series-parallel. The master controller used is of the non-automatic type, and has two handles, one regulating the applied voltage at the motors and the other controlling the direction of rotation of the motors. The rheostats which form the external motor resistance are placed near the roof of the cab, and provided with ample natural ventilation.

The master controller and contactor energising circuits are designed for 125 volts. Each contactor is easily accessible without any disturbance to adjacent contactors. A special electro-pneumatic change-over switch is used for making the transition between series and series parallel connection of the pair of motors.

The 125 volt current for operating the contactors and for lighting the cab and headlights is obtained from a motor generator set, the motor of which has two 1,200 volt windings and two 1,200 volt commutators in series for operation on 2,400 volts. This set is mounted in the centre cab. and also drives the blower for providing forced ventilation to the main motors.

Fuses of the copper ribbon type placed in the fuse-boxes provide protection for each individual circuit as well as the main circuit from the trolley. These fuse-boxes are all arranged to blow into a common chamber designed to take care of the arc. In addition to the fuse on the main circuit, a main switch is also provided. This is of the knife-blade type, being opened and closed by a handle in a position for easy operation in case of emergency, or when it might be necessary to open the circuit while carrying current. This main switch blows into the chamber provided for the fuses, and has a powerful magnetic blowout.

The trolleys are of the slider pantograph type, pneumatically operated and mounted on insulated bases. Two pantographs are used per locomotive.

A speedometer, similar to the type largely used on automobiles, but especially designed for locomotives, is located in each operating cab. These are connected to the driving wheels of the locomotive by means of flexible shaft and gearing.

A combined straight and automatic air brake equipment is provided on each locomotive. This equipment includes a 2,400 volt motor-driven air compressor, the set consisting of two 1,200 volt motors operating in series on 2,400 volts, and direct-connected to an air compressor having a displacement of 100 cu. ft. of free air per minute. The approximate total weight of each locomotive is 83 tons. Some of its principal dimensions and characteristics are given in the following table :—

Length inside knuckles	37 ft. 4 in.
Length over cab	31 ft. 0 in.
Overall height, pantograph down	15 ft. 6 in.
Height over cab	12 ft. 10 in.
Overall width	10 ft. 0 in.
Total wheelbase	26 ft. 0 in.
Rigid wheelbase	8 ft. 8 in.
Total weight, on all drivers	83 tons.
Wheel diameter	46 in.
Tractive effort at 30 per cent. tractive coefficient	49,800 lb.
Tractive effort at one-hour rating	20,300 lb.
Tractive effort at continuous rating	16,200 lb.
Speed at rated amperes, one-hour rating	23·4 miles per hour.
Total horse-power, one-hour rating	1,280 H.P.
Speed at rated amperes, continuous rating	24·6 miles per hour.
Total horse-power, continuous rating	1,090 H.P.

Gearing, 80–25 Reduction, 3·2.

The multiple unit motor cars for handling local traffic are not yet in operation. The principal dimensions of these cars are given in the following table :—

Length over buffers	67 ft. 5¾ in.
Length over body corner posts	57 ft. 6¼ in.
Truck centres	42 ft. 9 in.
Width over side sill angles	9 ft. 10½ in.
Width over eaves	10 ft. 2¾ in.
Height top of rail over roof	13 ft. 0 in.
Height top of rail to underside of side sill	3 ft. 7½ in.
Centre to centre of body side bearings	4 ft. 10 in.
Centre to centre deck sills	5 ft. 6 in.

The approximate weight of the car loaded and equipped is 160,000 lb. The electric hot-air system of car heating is used. One complete heater is placed underneath each car, and receives its energy direct from the 2,400 volt supply. The heater has a capacity of approximately 25 KW., and is constructed for two heat combinations, so as to provide for the changes in temperature conveniently and economically.

The complete heating equipment consists of the heating unit, blower and regulating mechanism, the controlling switch and thermostat of the regulating mechanism being arranged for operation from the

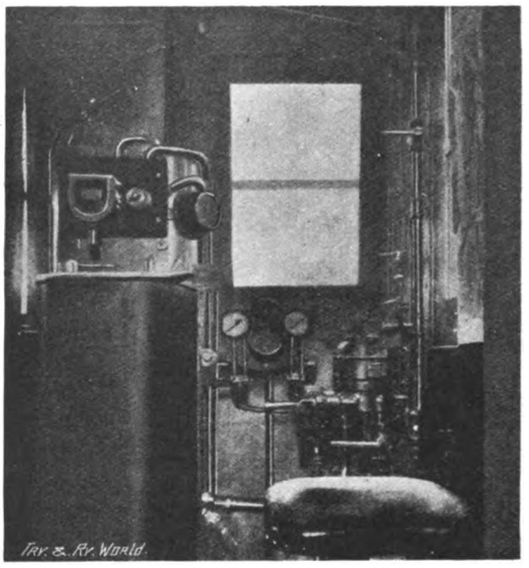

Fig. 4.—Control Apparatus in Locomotive Cab.

600 volt supply. Air is forced over the heating unit by means of the blower, and distributed to the car through the air ducts along the sides of the car. The blower used for the circulation of the air is operated by a motor which is connected in series with the heating unit on the ground side. The capacity of the blower is approximately 1,000 cu. ft. of air per minute.

The motor equipment consists of four fully ventilated, 125 H.P., 1,200 volt commutating-pole motors insulated for 2,400 volts. Two of these motors are permanently connected in series for 2,400 volts operation. Ventilation of the motor is accomplished by drawing air into the armature at the pinion end by means of the fan on the armature shaft. The air passes longitudinally through the whole interior of the motor, and is expelled through an opening in the frame at the commutator end, protected by wire mesh.

The control is of the non-automatic type for multiple-unit operation. The equipment includes a motor-generator set for furnishing 600 volt current for the control circuits, the air compressor, and lighting circuits. This set consists of two 1,200 volt motors, operating in series on 2,400 volts, direct-connected to a 600 volt generator. The master controller, con-

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tactors, switches, reversers, and pantograph are essentially the same construction and appearance as those already described for the locomotives. The controller has five steps in series and four steps in parallel. It differs from the locomotive controller in having the usual motorman's operating handle instead of a lever. This handle is provided with the so-called "dead man's" feature for cutting off power and applying the air brakes in case the motorman removes his hand. Copper ribbon fuses similar to those on the locomotive are used, and an aluminium cell lightning arrester is installed on each car.

Special local conditions and extremely low temperatures introduced features making the design of the catenary system for this electrification somewhat out of the ordinary. The electrified track at present is about 10 miles long, and in this distance there are a passenger terminal station and coach yard in the city, a double track tunnel, double tracks in a cut with low clearances under highway bridges, a long stretch of single track, both tangent and curve, and a large freight yard with repair shops and storage tracks. The temperature in the coldest winter weather reaches 35 deg. below zero, while in the hottest summer weather it will go as high as 110 in the sun. In the early spring severe sleet storms sometimes occur.

The poles are of Eastern white cedar. The specifications for these poles and also for the creosote oil used as a preservative, were based upon those of the National Electric Light Association. Steel poles are used in the terminal yard in the city on account of their more sightly appearance. The wood poles are set seven feet in the ground, and are all back-guyed. They are long enough to carry two cross-arms for feeders, signal circuit, and a three-phase transmission line for supplying the shops in the Cartierville Yard with electric power. On top of the poles there is a No. 000 copper ground wire, which serves both as a protection against lightning for the circuits on the poles and also as a preventive against any trouble that might be caused by breakage of the rail bonds, which latter are of the welded U type. The poles throughout the single track construction are spaced 150 ft. on tangents and 20 ft. on the 2 deg. curve. On the double-track portion, where the overhead clearance is limited, the spacing is reduced to 105 ft. on tangents.

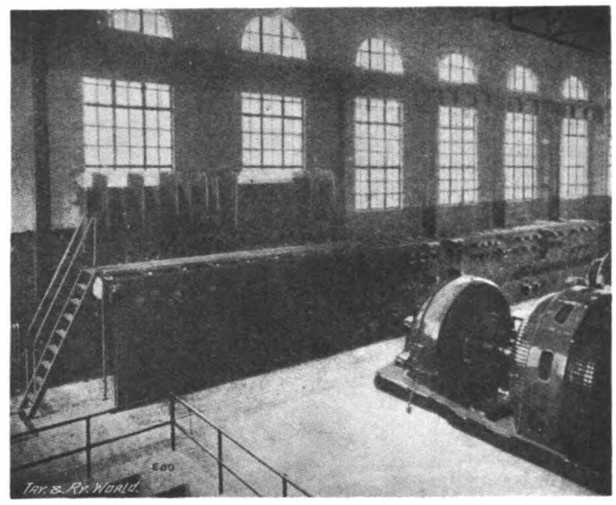

Fig. 5.—Interior of the Sub-Station.

The messenger for the electrification outside the tunnel consists of a ½ in. seven-strand Siemens-Martin steel cable, with an ultimate strength of 11,000 lb., and an elastic limit of 6,600 lb. Two No. 0000 copper feeders are installed on the full length of the electrification outside the tunnel, and the other for about one mile west of the sub-station.

The messenger is anchored every half mile. This is accomplished by running the end of one half mile length past the end of the next for a distance of one span. It is then made fast to an anchor eye on the bracket through an insulator and turn-buckle, and the same point of the bracket guyed back to the next pole, which in turn is guyed against this strain. The two messengers where they pass each other are kept from eight to ten inches apart. By anchoring the trolley wire on the same bracket the anchorage becomes a section insulation, the air space between the messenger and trolley wire forming the insulation. Where a section insulator is not required a copper jumper is placed between the messenger and trolley wires.

For the double-track portion of the line cross-span construction is used, the cross-span being a ⅜ in. seven-strand Siemens-Martin steel cable. The messenger is fastened to this by means of a small malleable clamp. This cross-span is made up with a turn-buckle, strain insulator, and wedge grip in each end, and fastened to the poles by means of eye-bolts.

In yard work spanning more than two tracks the construction is similar, but with the addition of a cross messenger of ½ in. cable above the ⅜ in. cable. This cross messenger is made fast to the poles directly, without insulators or turn-buckles, and carries the weight of the spans below through lengths of ¼ in. steel cable. These fasten to eyes in the tops of the messenger hangers, and to the cross messenger by means of Crosby clips. There is a strain insulator in each of these lengths.

Pull-offs are used on curves for holding the contact wire and messenger in the correct position over the track, and at intervals on long tangents for steadying the contact wire. The pull-offs are made of Sherardised steel tubing bent to avoid fouling the pantograph. Each pull-off is fitted with a clamp ear at one end and an eye at the other. Adjustable links are sometimes required with the pull-offs to keep the trolley wires the right distance apart at certain points, such as where the trolley wire for a turnout approaches the main trolley wire at an angle. Each link is composed of two malleable iron brackets, with clamp ears, connected by means of a ½ in. pipe, the length of which is adjusted between the brackets and held by set screws.

Porcelain strain insulators are used in two sizes. The larger, used with ½ in. and ⅜ in. steel cable, withstands a wet flash-over test of 14,000 volts, and has a breaking strength of 22,000 lb. The smaller, used with ⅜ in. and ¼ in. steel cable, has a breaking strength of 12,000 lb. The insulator used on the bracket construction is of the ordinary glazed porcelain, double petticoat, pin type, 4½ in. in diameter. It has a wet flash-over test of 20,000 volts. The messenger rests in the groove in the top of this insulator, and is not tied except on curves.

The contact wire is of special bronze composition, size No. 0000, with a breaking strength of 65,000 lb. per sq. in. and an elastic limit of 39,000 lb. per sq. in. Its section is the standard of the American Electric Railway Association for No. 0000 grooved trolley wire The use of this wire instead of hard-drawn copper was thought advisable both because of its longer life when subjected to the wear caused by sliding pantographs, and also because it could be pulled up tighter than copper on account of its greater strength. This

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latter reason was considered of special importance because of the wide variation in temperature in Montreal with the consequent great variation in the sag of ordinary copper trolley wire between winter and summer. The trolley wire is hung straight over the centre of the track as the natural side sway of the pantograph is sufficient to prevent wearing grooves in the contact strips.

The height of the trolley wire above the top of rail is ordinarily 23 ft. except along the double-track

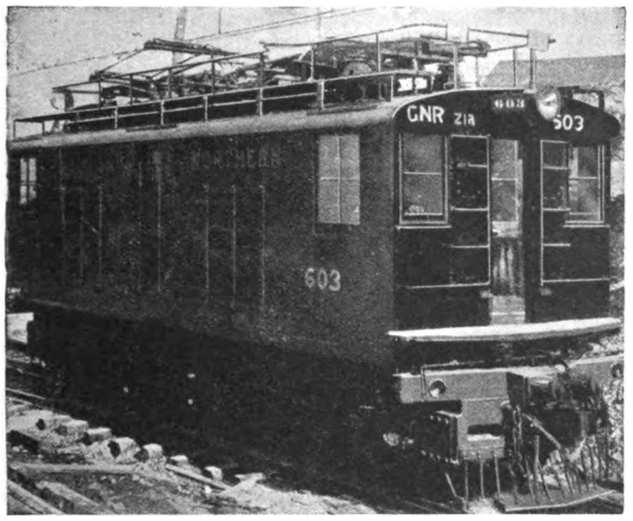

Fig. 6.—Locomotive Running under Low Catenary with Trolley Depressed.

construction and in the tunnel, where it is 16 ft. In this section two wires are used over each track. They hang side by side, supported from the same messenger, the hangers of one wire being staggered with those of the other. These double wires do not raise the hanger loops as high as would a single wire when a pantograph passes along, which is an obvious advantage where the head-room is limited. Sparking and consequent wear both of the contact shoes and contact wires is reduced to a minimum, as there is always good contact between the slider strips and one of the contact wires. The hangers are all of the long-loop type, having a malleable iron, single-bolt clamp ear, and a strap varying in length to suit its position. All parts are Sherardised. In spans of all lengths from 150 ft. to 90 ft. the hangers are spaced 15 ft. apart.

Lightning arresters of the magnetic blowout type are installed at half-mile intervals. The arrester is placed near the top of the pole, and the ground wire runs down the pole to a $\frac{3}{4}$ in. iron pipe driven about ten feet into the ground. Before driving this pipe, a 2 in. pipe was driven down about 5 ft., then withdrawn, and the hole filled with rock salt. The $\frac{3}{4}$ in. pipe was driven down through the salt. In addition to these arresters on the poles, aluminium cell arresters are installed in the sub-station on the positive busbars and on each feeder.

In order to string the messenger cable with the proper tension a dynamometer was used. It was therefore necessary for the foreman of the line gang to know what the tension should be at different atmospheric temperatures. The right sag at any given temperature was also of importance as a check on the tension. This information was supplied in the form of tables to which the line gang worked, the sags and tensions being given at 5 deg. intervals.

In the tunnel the overhead clearance was so limited that the catenary had to be very flat. This meant pulling the messenger up very tight for spans of reasonable length. A cable of phosphor bronze was decided upon, composed of nineteen wires, and having an overall diameter of 0·888 in. This cable has an ultimate breaking strength of 22,000 lb. and an elastic limit of 18,600 lb.

This messenger is supported every 90 ft. from the roof of the tunnel by a combination of iron yokes held in the concrete by four 1 in. bolts. The cross yoke carries the messenger insulator, and is supported on two insulators carried on the two end yokes, so that there are two insulators between the messenger and the ground. The insulators are of glazed porcelain, and have a wet flash-over test of 20,000 volts. All clamps and small parts of the messenger supports are of malleable iron Sherardised. The yokes are of 2 in. by $\frac{5}{8}$ in. and $1\frac{1}{2}$ in. by $\frac{7}{8}$ in. mild steel, painted with an asphaltum compound as a protection against rust. Two No. 0000 phosphor-bronze contact wires hang side by side from the messenger. The hangers for each contact wire are spaced 15 ft., or 7 ft. 6 in. between adjacent hangers. The hanger lengths vary from 6 in. to $13\frac{3}{4}$ in., with a 90 ft. span. The two hangers nearest the messenger support, namely, those $11\frac{1}{4}$ and $13\frac{3}{4}$ in. in length, are made with two loops one sliding inside the other, where the clearance to the roof is small. The remaining hangers are similar to those used outside the tunnel, except that the loop is wider in order to take the larger messenger. It was found that the two messenger cables and the four contact wires over the two tracks in the tunnel would give ample conductivity, so that no feeders through the tunnel were required. Both the messenger and contact wires are anchored every half mile. Two "bridles" of $\frac{1}{2}$ in. steel cable are fastened to the messenger by means of six $\frac{7}{8}$ in. Crosby clips, and the ends of these bridles fastened each way, through two cemented-type strain insulators in series, a turn-buckle and wedge grip to roof plates. The contact wire is anchored by lapping the ends for a distance of one span, and then carrying each end up and slightly to one side

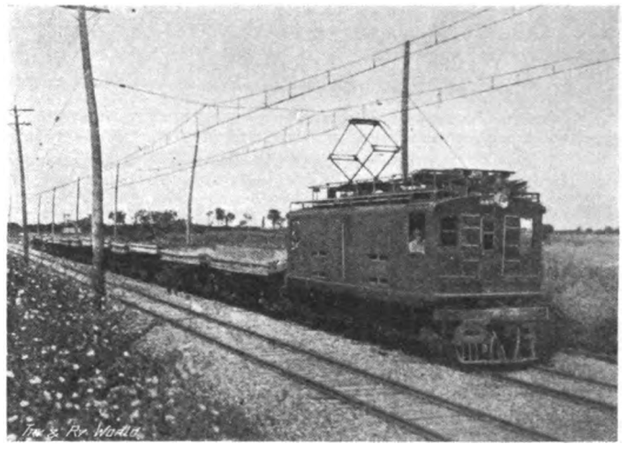

Fig. 7.—Catenary Construction on Straight Track.

of the centre, making fast to a roof plate through two insulators, a turn-buckle, and a wedge grip.

At the only curve in the tunnel, one of 2 deg., two pull-offs are placed in each span, over each track, one for each of the contact wires. The pull-offs are fastened to the tunnel arch through two strain insulators in series by means of an expansion bolt. The two pull-offs are placed 7 ft. 6 in. apart, and this arrangement prevents hard spots and at the same time keeps the two contact wires close enough together for satisfactory operation.

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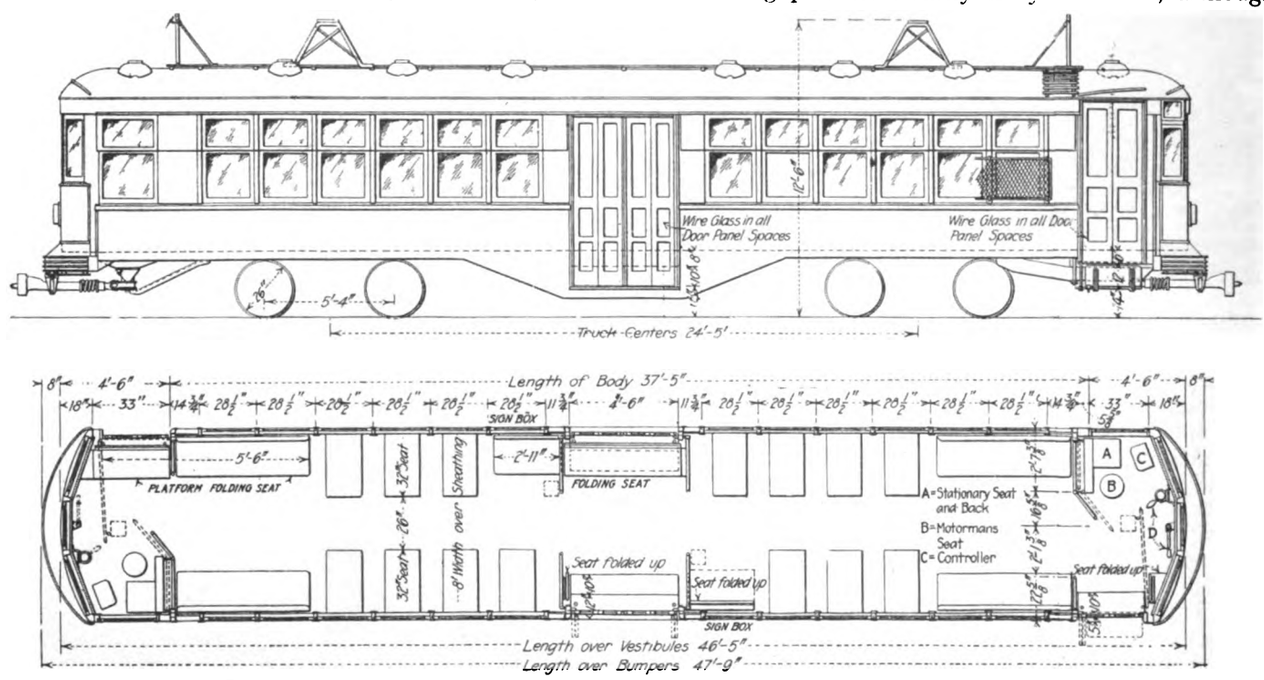
AMERICAN STANDARD TRAMWAY CAR.

Soon after America entered the war, the War Board of the American Electric Railway Association appointed a committee to devise plans for a standard street railway car, and toward the end of last year the designs were published. The committee held several meetings at Washington, made a thorough examination of various plans and specifications, and finally approved a type of car which they considered would best meet the requirements of the United States Bureau of Industrial Housing and Transportation, of the public, and would be acceptable to the representatives of the companies and the car builders.

As will be seen from the drawings which we reproduce, the standard car is of the double truck, single-deck type, with vestibule ends, and is so arranged that it can be run as a single car or coupled in trains. Entrances and exits are provided at the ends and in the centre, where the floor is brought within 14 inches of the rails, so that passengers can step directly from the floor of the car to the street level.



Plan and Elevation of the Standard Tramway Car of the American War Board.

The car illustrated is so designed that it can be operated by one or two persons. The War Board strongly advocated the adoption of a one-man type of car wherever practicable, and it made a detailed report on the success of its operation in numerous cities. Organised labour in some instances had opposed the use of this type of car, and it was the object of the report to demonstrate the necessity of using this type of car to meet certain conditions, and to show how it can be operated by one man.

The car, as described by the *New York Electric Railway Journal*, is 47 ft. 9 in. long over all and 8 ft. 2 in. wide over all. It is expected that these limiting dimensions will give the necessary clearance in the cities where this car is likely to be used. The end platforms are 4 ft. 6 in. over the dashes with a clear entrance of 30 in. The side door has a clear opening of 48 in. The platform floors are on the same plane as the body floors, thus calling for three entrance steps as follows when a 26 in. wheel is used :—From ground to first step, 14 in.; from first step to second step, 12 in., and from second step to floor, $6\frac{5}{8}$ in.

The exit steps at the side are as follow :—From the floor to first step, $8\frac{5}{8}$ in.; from the first step to the second, 10 in.; and from the second step to street, 14 in. These latter steps are fixed and within the car.

As it was the intent of the bureau to get a car for average rather than for exceptionally congested conditions, a comparatively short platform is used. From a constructional standpoint, this would mean a reduction in weight and maintenance ; nor is the shorter length an operating disadvantage because, after all, the throat of the platform at the fare box and the seating arrangement are more important than the width of the steps. Weight and cost are also saved by the use of flush platform floors.

Further to save weight and reduce accidents, all ramps and wells have been avoided. The passenger who uses the side door steps directly from the car-floor level to the exit steps on the side of the car.

Since the car is arranged for double-end operation, the seating plan necessarily is symmetrical, although the car end may be used on both the pay-as-you-enter and pay-as-you-leave plans. The seats adjacent to the platforms are longitudinal, while the rest are transverse. Folding seats are provided in staggered relation to the side doors, one for three passengers and one for two. Other folding seats are available according to the direction of running.

As a single-end one-man car the seating capacity is 61, as three permanent seats can be added to the rear platform. As a double-end one-man car, the seating capacity is 58. As a single-end two-person car, the seating capacity is 56, while as a double-end two-person car it is 53.

Transverse seats have been applied wherever they could be used without interfering with the flow of traffic. The seats are 32 in. over all, but their actual seating space is 35 in., because the seats are set 3 in. from the wall of the car. Should the cars be used in a climate demanding no heat insulation, the aisle width between the cross seats would be 26 in. instead of $24\frac{1}{2}$ in. The seats will be made of wood, steel, and rattan.

All doors are of the folding type, air operated, and hung on ball-bearing type hinges. The end doors

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are of the single folding type, with two leaves, and the centre doors are of the double folding type with four leaves. All doors have rubber cushions, and the lower panels are glazed in wire-glass. Among the reasons for operating the doors by air are the elimination of manual labour, the quicker action of the doors, the increased efficiency of fare collection, and the decreased likelihood that cars will ignore would-be passengers.

The arrangement of steps, doors, and seats is adapted to any kind of fare collection desired. If the car is used for heavy terminal loading at a prepayment area, passengers are at liberty to enter through one front and two centre passageways, totalling 6 ft. 6 in. If used as a pay-as-you-enter car, passengers will enter by the front platform, and pay as they pass the conductor, who is stationed forward of the centre door. In emergencies every door on the car can be unlocked. As these cars are likely to be distributed among different companies, no attempt has been made to specify the mechanical details of fare collection.

The total weight of the car, completely equipped, is estimated at 34,700 lb. using four 40 H.P. motors, multiple-unit control, couplers and other train-operating apparatus; or 30,700 lb. if equipped with four 25 H.P. motors and arranged for single-car operation only. In view of the decreased weight of these cars compared with preceding types of like capacity, their schedule speed with motors of the powers mentioned will tend to run about 10 per cent. higher. The air brakes will include safety control equipments, whereby control, brakes, doors, steps, and sanders will be interlocked as on the standard one-man safety car. Electric heating and thermostatic control are specified, the number of heaters to vary with climatic conditions, but usually ranging from eighteen to twenty-four. Ventilation will be provided through sixteen exhaust ventilators of approved type. The lighting circuit will comprise five circuits of 23-watt Mazda lamps, with two circuits so ranged that either headlight can be turned on or off from either end of the car. Push-button buzzer signals will be available for the passengers.

Buttons will also be provided in al control stands for signalling between the motorman and the conductor or conductors. All wiring will be placed in a flexible, featherweight conduit.

The car will have straight sides, round vestibules, arch roof, all floors on one plane, folding doors and steps on right-hand side of each platform, folding doors and stationary steps on each side of centre of car, open bulkheads and two sashes per window opening with top sash stationary and the lower sash arranged to raise. The general construction of the body is steel of commercial shapes with wood finish. Side posts and carlines will be formed as continuous pieces from sill to sill. The roof boards will serve as the ceiling.

The underframe will consist of standard commercial shapes. Two centre sills will extend from the body bolster to the bumper. Because of this through construction, a sectional end sill reinforced underneath with a channel iron will be used, all be ng tied together with a gusset plate. Diagonal braces will extend from the gusset plates to the ends of the vestibule. Diagonal braces will also be used between the drawbar fulcrum and side sills of the car. The ends of the car will be fitted with anti-climbers.

The reinforcement at the side openings consists of the usual cross-sill plus a channel iron which forms an arch from side sill to side sill. The pier panels at the side doors are reinforced inside with an extra plate. The letterboard is made of steel reinforced at the top with angle irons to give the necessary strength. The side girders are of No. 12 sheet steel, rivetted to the side sills, seat rest, and window rest angles, and to the T-posts. At splices there is a plate on each side. The dropper bar is rivetted through the window rest angles. The inside of the car will include a truss plank extending from the floor to the seat-rest angles, and a composition board will be placed between posts extending from the seat-rest angle to the window-rest angle. An air space is provided between the truss plank, the composition board lining and the outside steel girder. As the cars must be adapted to the greatest variety of overhead clearances, it was thought advisable to keep the roof low. Hence the proper height of trolley base, where necessary, is to be obtained by using the elevated stand of angle iron now so familiar through its common use on the safety car. The use of the stand also tends to reduce the noise of the trolley, and saves the roof ventilators from being damaged by trolley poles.

Single-thickness car flooring of yellow pine will be used, with $\frac{5}{8}$ in. maple floor strips on the platforms and in the aisles. Besides their use on all steps, safety treads will also be set in flush in the flooring at all door openings.

The trucks will be of the swing bolster type, having an interposed spiral spring above the plate spring and provided with a bolster guide. The wheelbase will be 5 ft. 4 in. and the wheels 26 in. Truck centres are 24 ft. 5 in. apart.

LONDON TRAFFIC COUNCIL.

ACTION BY MUNICIPAL TRAMWAY MANAGERS.

A Municipal Traffic Council for Greater London has been formed. Meetings of municipal tramway managers of the undertakings in the metropolitan area have been held, at which the question of the present and future position of passenger transit facilities in and around London was discussed, and consideration was given to the expediency of taking joint action to promote the interests of the undertakings concerned.

With this end in view it was decided :—

(1) That the Metropolitan Association of Tramway Managers, which included in its membership managers of both municipal and company-owned tramways, should be dissolved.

(2) To recommend that a new association, to be known as the Metropolitan Municipal Traffic Council, be formed, and—

(*a*) That such council consist of municipal authorities owning and working tramways and/or motor vehicles.

(*b*) That the municipal authorities be represented by not more than two members of each authority and the managers of the undertakings concerned.

(*c*) That meetings of the council be held quarterly.

(*d*) That meetings of the managers be held at least once in each month.

(*e*) That under the proposed constitution the managers to act jointly in an advisory capacity to the council on all matters which affect the common interests of the undertakings in the metropolitan area.

These proposals have been forwarded to each of the municipal tramway authorities in the metropolitan area, with a request to appoint representatives to attend a conference to consider the question.

New Cars for Toronto.—The Toronto Railway Company are equipping their entire system with the latest type of p.a.y.e. vestibules. The latter are provided with folding doors and folding steps, which are worked pneumatically from a lever placed convenient for the conductor, who stands in a small railed-in compartment, where there is a p.a.y.e. fare-box and a push button to signal the motorman. The motorman does not start until the signal lamp glows. When it goes out he throws off the power and applies the brake. The danger of the doors closing too rapidly and catching passengers in leaving or entering the cars is obviated by two strips of rubber tube attached to the doors. Any object caught between the doors merely receives a slight pressure. The *Canadian Electrical News* of January 15, which contains an illustrated description of the cars, says that they are the result of an investigation of the most efficient types in use in America.

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Revival of Tramway Construction Work.

A cheerful feature of the opening weeks of this year has been the considerable number of tramway authorities in this country that have advertised for tenders for new cars and omnibuses. They satisfied themselves before they asked for bids that the manufacturers are now in a position to fulfil their wants, although it is not expected that delivery will be rapid. This indicates a gradual return to pre-war conditions. The demands of the military authorities on engineering firms and on iron and steel manufacturers have now so slackened that probably a great increase in output for civilian purposes will soon be available. Moreover, besides the men released from munition work, the number of soldiers released from the army is becoming so great that the labour shortage must soon be much less troublesome. Things promise well in fact, were it not for the constant menace of labour troubles. It is worth noting that the new call for additional rolling stock was in the first place for omnibuses, the reason being that much earlier delivery of these could be promised than in the case of tramcars. That stage appears already to be over, and tenders for cars are now being freely invited. It is amusing to note, by the way, that in some quarters it appears to be thought that it is a new development for tramway undertakings to ask for omnibuses in order to supplement their tramway services. It is not a new feature, but it is more prominent at present because of the urgent necessity for additional means of transportation. The great increase of passengers during the war still continues, and every means of local communication is strained to its limit. There are great arrears to make up both in cars and omnibuses. Prices must, for some time at least, continue high, but renewals, additions, and extensions are urgent. That remark applies also to track repairs, and as soon as plenty of labour is available, hundreds of miles of new rails will have to be laid down, no matter at what cost. There is every prospect of an increasing supply of rails before long, but there is no prospect of prices returning to anything like pre-war level for a long time to come. Manufacturers of tramway supplies and materials have probably better prospects immediately in front of them than the operators of tramways have. What the latter require is a continuance of heavy traffic and of increased fares, together with some more or less permanent settlement of the labour trouble which has for some time been so menacing.

Railways v. Automobiles.

It is a remarkable fact that the proposals of the Ministry of Reconstruction for the provision of a system of narrow gauge light railways for the benefit of agriculture should have provoked an outburst of wrath from certain automobile interests in the country. For some more or less mysterious reason there is a section of the automobile interest on whom anything in the nature of a railway or a trmway seems to produce an effect like that of a red rag on a bull. The real fact is that in the development of the country there is ample scope both for light railways and for the use of motor wagons and lorries. Delimitation of spheres and arrangements for the one system helping the other so as to form parts of a general scheme are quite capable of arrangement. For the main work of hauling large quantities of goods and produce over considerable distances, there can be no doubt that cheap, narrow gauge light rail-

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ways possess advantages over the motor lorry. The latter ought to come in for local extension and branch work, and should prove a valuable auxiliary. The Ministry of Reconstruction, before preparing their memorandum in favour of "agrails," considered the alternative of road motor vehicles, and for the main purpose preferred the railway. They made one significant remark as to the likelihood that in the near future the owners of heavy motor vehicles will have to contribute substantially to the cost of upkeep of the roads they use. At present, while the railway maintains its own track, the motor wagon has its track provided and maintained at the cost of the ratepayers. Which would the latter prefer—a train of narrow gauge trucks running on rails laid on the roadside waste, or a "fleet" of heavy motor wagons wearing out the roads? One train on the railway will carry as much as many motor wagons, and it will require only one steam engine or electric locomotive, instead of many petrol or steam engines. Something of the attitude of mind of the critics may be gathered from the remarks of a writer in a weekly general newspaper. We are told, for example, that the light railways take away from their legitimate use a proportion of the highways to make them into railways. It is obvious, of course, that any part of these light railways which is laid on roads will require to have the rails flush with the surface, as in the case of a tramway. It is claimed as an advantage for the motor lorry that it can be taken off a non-paying route and transferred to a better without trouble or expense. That gives the case away. The light railways are to be provided for the development of agriculture. If some of them do not pay, they are still to be operated, so that agriculture may continue to be benefited, and the loss is to be made up from the profits on the lines which do pay. It is to be a comprehensive scheme, not a congeries of motor lorries running only on routes which pay the owners. It is also said that the use of the motor lorry involves no extra cost for permanent way. Precisely. The farmer who is supposed to benefit is to pay for the permanent way, which happens to be the public road. Readers may be recommended to study the opinion of such an authority as Sir Evan Jones, chairman of the Road Transport Board, as revealed in his evidence before the House of Commons Select Committee on Transport. It is full of impartial wisdom.

The Future of London Traffic.

With the passenger services and the related subject of housing accommodation forming the most prominent questions to engage the attention of the electors in the election of the London County Council next month, the proposals of the three parties appealing for support are of much interest. Labour, which has only three representatives on the present Council, advocates public ownership of omnibuses, cabs, railways, etc. For the Progressives, the Rev. J. Scott Lidgett adheres to the proposal of a municipal highways and traffic authority which in the past has been responsible for causing more than one Government to refrain from carrying out the recommendation of the Royal Commission for the creation of a Traffic Board. He also insists "that such large powers of control over motor omnibus traffic must be obtained as will prevent the present wasteful and dangerous competition and utilise all possible means of locomotion for the convenience of the public." Further, Dr. Lidgett urges that the tramways must be developed and completed, following the abolition of the veto of the Borough Councils, and that pre-war fares and facilities must be restored. How the latter desideratum is to be accomplished in the face of vastly increased working expenses and the further cost of granting any of the concessions claimed in the employees' national programme, Dr. Lidgett does not explain. In this respect the Moderate party stand on firmer ground, in that their manifesto promises restoration only to the extent that will prevent the tramway undertaking becoming a charge upon the rates. The party now in power also intend "to develop the system in order that it may be worked with the maximum efficiency and convenience to the public." This means that efforts will be made to secure the carrying out of the proposals made a year or so before the war for the abolition of dead ends and for the construction of further extensions. Evidence of the party's sincerity in this respect is shown by the Highways Committee's report presented to the Council on February 5, but the difficulty

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of making extensions while the cost of materials remains at the present inflated figures is likely to delay the schemes. They further point out that uncertainty is inseparable from proposals which require the consent of the road authorities. The obstructive veto would doubtless be one of the subjects to be tackled by the Royal Commission or the Government Committee which the Moderate party urge should be set up to report upon the question of giving to London and the adjoining areas a unified form of government. The manifesto declares that under the present conditions it is impossible to deal efficiently and economically with a number of questions. Of these matters traction and housing facilities stand pre-eminent, and must be dealt with at once. An effort is being made to solve the problem on voluntary lines, as is shown by the recent formation of a non-official committee to devise plans for a Traffic and Development Board for London and the Home Counties. If, as is not unlikely, this dual question is taken in hand by Sir Eric Geddes, the Minister of Ways and Communications, the co-operation of all interests will be imperative if the capital and the surrounding country is to be given adequate traction facilities. That necessity no doubt animated the mind of Mr. G. H. Hume, the chairman of the London County Council Highways Committee, who is a member of the committee referred to, when he remarked to an interviewer that "tubes, tramways, and omnibuses at present are operated on the strictly individualistic method, and the Council will be asked to press for a reconsideration of the problem by the Government."

New Attributes of the Omnibus.

The extensive use that provincial tramway undertakings have made of the motor omnibus has proved the claims which have been advanced for that vehicle in these columns and at numerous conferences. The war has served to accentuate its merits, and now that the winning of freedom for the world enables tramway proprietors to devote attention to the restoration of tracks and cars, further claims are being made for the utility of the omnibus. Managers have assembled in queues at the offices of manufacturers, but find that no dates can be named for the delivery of the new cars so urgently needed, while prices have more than doubled. New cars are required not only to enable the needs of increased traffic to be met, but to replace worn stock and to open up services on extensions the construction of which is long overdue. Faced by these obstacles, tramway operators are turning to the motor omnibus, which can be obtained with comparatively little delay. The chassis now procurable has the advantage of embodying improvements wrought by the severe war test, and the price has not appreciated to the extent experienced in the case of cars. Beyond this advantage which the omnibus offers for certain traffic in an emergency, there are other attributes that have arisen out of the situation created by the war. These claims are of so vital a character that they have led the Highways Committee of the London County Council to recommend that application be made in the ensuing session of Parliament for powers to use omnibuses for the linking up of dead ends of the tramways and the provision of similar means for joining up termini with outlying districts. The popularity of the omnibus upon both suitably and unsuitably paved roads in the metropolitan district is proof that the public will welcome such a service. Before the tramways were brought over the bridges private interests prevented the Council obtaining power to provide horse omnibuses for linking up the southern and northern lines; but it is difficult to conceive of the present application not securing assent, if reasonable efforts to arrive at a working agreement with existing omnibus interests fail. The committee's reasons for promoting the Bill are in themselves the finest tribute to the motor omnibus. The first is, in the words of the Highways Committee, that the war has been responsible for a new financial consideration, viz., the increased cost of tramway construction. Next the committee state that the omnibus provides the practical way of meeting the requirements of the public with the least possible delay. Another reason is that the war has entailed four years' delay in the linking up of dead ends by means of tramway extension. It is also observed that the provision of omnibuses on trial routes is a necessity for the tramway undertaking in connection with districts which are being slowly developed, and

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that unless adequate services can be provided, pending the construction of tramways, the extensive housing policy shortly to be inaugurated may be seriously affected. It is because housing development must in the main take place outside of the county boundary that powers are to be sought to work omnibuses in the districts beyond the tramway termini, which, without exception, are likely to be several miles from the new settlements.

THE "AGRAILS" SCHEME.

Some further reference may be made to the scheme for the construction of light railways of narrow gauge in agricultural districts which was explained briefly in our issue of January 16. The evolvers of the proposal are the Ministry of Reconstruction, and to them is due the suggestion that the lines should be called agrails. The object of coining this word is to distinguish the proposed light railways from all other sorts of railways, tramways, and tramroads. It may be recalled that the form of construction contemplated is neither a light railway nor a tramway in the ordinary sense. The track would be a kind of tramway of 2 ft. gauge, cheaply constructed and easily laid and lifted. It would be laid on roadside wastes and on the road itself where necessary, and only to a limited extent on private land. The capacity of the wagons would be increased by building them with a considerable overhang. Passenger cars would be run, but the primary purpose of the agrails would be the carriage of agricultural supplies and produce, coal, road materials, etc. A maximum speed of 20 miles an hour is suggested. The traction would be by steam or electricity, according to local conditions, and where the rails are carried into sidings on farms, petrol tractors or horses would draw the wagons.

The scheme which has been worked out involves the formation of a body to be called the Agrail Board, representative of the Board of Trade and of agriculture. This Agrail Board will promote and construct the lines and lease them to companies for operation. Details as to finance are not yet settled, but among possible alternatives is one under which the cost of construction would be met jointly by the Development Commission and by the local authority. The working expenses would, of course, be met by the operating companies.

A crucial matter is the acquisition of land. The difficulty and cost of acquiring land for public purposes has always been a stumbling block. In England a price of about 10 per cent. above the ordinary value has generally been allowed, while in Scotland the price has been on the basis of 45 years' purchase, equal to a tax of 100 per cent. Mr. Leslie Scott's committee of the Ministry of Reconstruction, reporting recently on the acquisition and the valuation of land, recommended that such bases of valuation should be swept away, and that there should be no extra payment at all because land is acquired for public purposes. This proposal is likely to be adopted. On the other hand, it is hoped that the proposed light railways will utilise private land as little as possible. As far as may be they are to be laid on waste at the side of public roads, and where necessary on the roads themselves, so that the capital cost may be kept down. That there is great need to reduce the initial cost is plain from the fact that in this country hitherto light railways have cost, exclusive of equipment and rolling stock, well on for £6,000 per mile. In Belgium the figure was nearly £4,000, but this included rolling stock.

A useful suggestion is that the Agrail Board should be constituted as a limited liability company of the public utility society type, with directors appointed by the Board of Trade in consultation with the Board of Agriculture. Such a scheme would provide for one of the directors being a salaried expert light railway engineer.

A possible procedure may be outlined in this way. A local authority desiring to provide improved facilities would apply to the Agrail Board for a survey, a preliminary inquiry, and a rough estimate to be made. A *prima facie* case having been made out, the Agrail Board would prepare plans, estimates, etc., and would then ask the local authority to contribute 50 per cent. of the cost, the Development Commission supplying the rest. Then would come an application to the Light Railway Commissioners for an Order. The usual procedure would here be followed, and the Order when confirmed by the Board of Trade would provide for the compulsory acquisition of any land required. The Agrail Board would construct and equip the line, and lease it to an operating company, the capital of which would require to be only very small.

Such an arrangement would at all events closely follow that in Belgium where the capital is subscribed by the State, the provinces, and the communes, where the Local Railways Society has the general supervision, and where companies work the lines. The general return on the capital of the Belgian system is only 3 per cent. or less, and this is reached by averaging the lines which pay well with those which do not. Similarly, no one can expect a little gold mine in agricultural light railways. They are intended for the good of the country, and only a limited return on capital can be looked for.

In regard to the use of a 2 ft. gauge, railways of this size have been extensively used at the front during the war, so that much ready-made material exists, and more can be readily manufactured. Wagons and passenger carriages can be made with a considerable overhang, so as to give reasonable accommodation.

With respect to the motive power for agricultural light railways, they cannot, of course, at present get an electric supply wherever they go, and in such cases steam would probably be employed. On the other hand, if the proposed national electric supply scheme goes forward, electricity will become available in a large proportion of rural areas.

CONDITIONS OF AMERICAN TRAMWAYS.

On its physical side the average electric street railway in the United States is in the same condition as the average tramway in Great Britain, that is, it is very much run down. Commenting on the situation, the *Electric Railway Journal* of New York remarks that even before the United States went into the war prices generally were so high, and money, labour, and materials were so scarce, that comparatively little maintenance work had been done for a long time. The end of the war, however, will put new hope into the engineers, for they know that in due time they will be able to get the track, rolling stock, and power plant into "85 per cent. new condition," which valuation experts consider as excellent maintenance. "We do not delude ourselves," adds our contemporary, "into the belief that this is going to be done all at once; it will take years to get back into normal shape."

A Halifax Extension Wanted.—Halifax Corporation have informed Stainland Urban Council that they will extend the Halifax Tramways to Stainland as quickly as possible, but owing to the shortage of labour and the high cost of material a definite date cannot be given.

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EXTENSION OF NEW YORK SUBWAYS.

MUNICIPAL CO-OPERATION WITH RAILWAY COMPANIES.

By the recent completion of extensions and improvements the New York subway system can claim to be the world's greatest achievement in electric railway construction. It consists of 619 miles of track, serves four of the five boroughs of the city, and has a capacity of three billion passengers per annum. New York, after five years of construction work and the expenditure of 400,000,000 dollars, or more than the cost of the Panama Canal, has completed and has put into operation the greater part of the city's new system of rapid transit known as the dual system because of the Interborough Rapid Transit Company and the Brooklyn Rapid Transit Company having co-operated with the city in developing it.

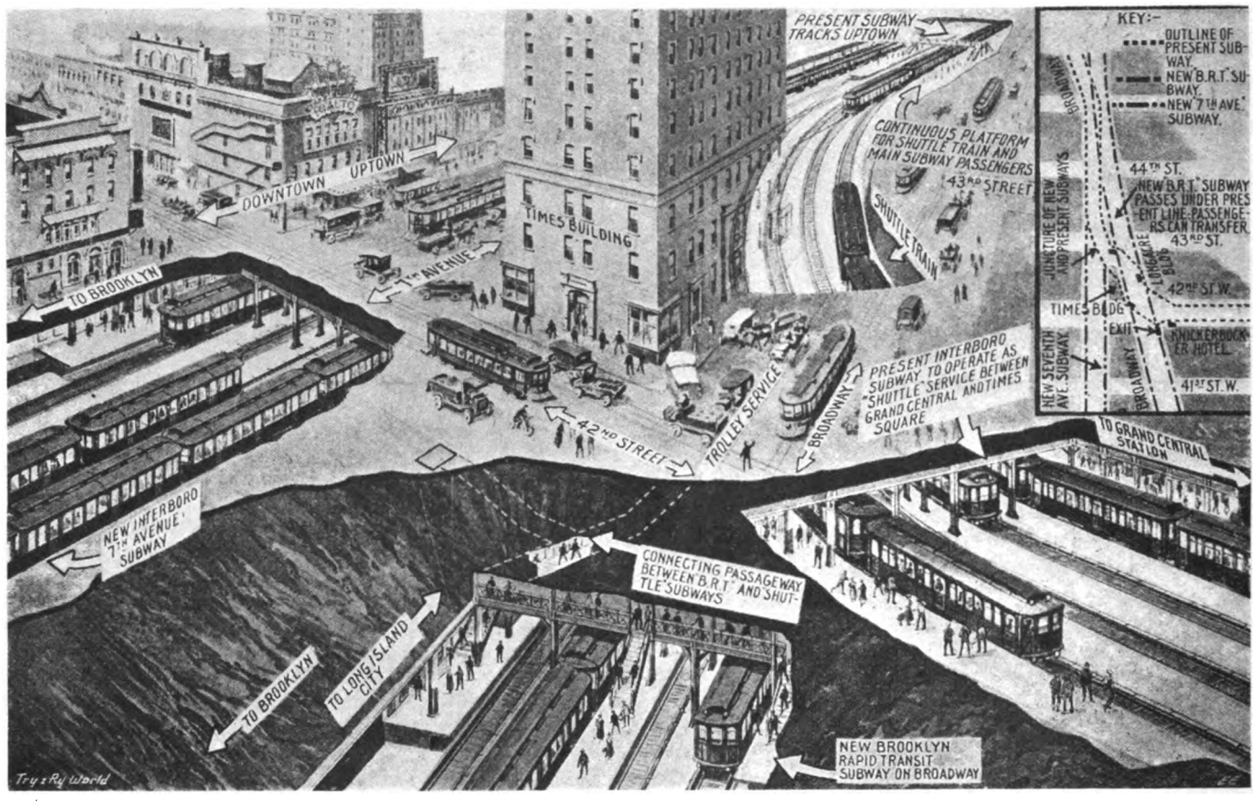
Four parallel elevated lines and a subway constituted the former rapid transit system in Manhattan. The subway started in Brooklyn, ran north through the eastern part of Manhattan as far as 42nd Street, west on 42nd Street to Broadway, and then north through the western part of the city, thus forming the so-called "Z."

In the new system the eastern part of the old subway has been continued south, thus forming two parallel and independent subways with a shuttle connection under 42nd Street. This arrangement is known as the "H." The eastern branch uses the old Brooklyn tunnel, while the western will later on enter Brooklyn through a new tunnel. These two subways are operated by the Interborough Rapid Transit Company.

A third subway is operated by the New York Municipal Railway Corporation formed by the Brooklyn Rapid Transit Company. This subway was built between two Interborough subways, which will eventually start in Brooklyn, pass under Broadway, Manhattan, and run over the Queensborough Bridge at 59th Street into Queens County. A fourth subway operated by the Interborough connects with the old subway at the Grand Central Station, and runs through the Steinway tube to Long Island City, thence into Queensborough.

Thus the railway mileage of New York City has been more than doubled and it has the most extensive subway system in the world, comprising more than two hundred miles of underground railway. Some of the subway routes have necessitated the boring of tubes under the East River at an enormous cost and difficulty.

To the elevated railways a third track has been added on which express service is provided during the rush hours, while instead of one subway there are now three with express service all day. Hence the transportation facilities have been increased five-fold in down-town Manhattan and three-fold elsewhere.



Subway Extensions in New York.

A large amount of new equipment was needed for the dual system. For this the Westinghouse Electric and Manufacturing Company furnished 600 control equipments for the New York Municipal Railways and 680 control equipments and 978 motors for the Interborough lines, the total cost of this apparatus being over 3,000,000 dollars. The power requirements are also greatly increased, and to supplement its present power equipment the Interborough Company has installed an 80,000 H.P. Westinghouse turbine generator.

The Ministry of Transport.—Progress is being made with the drafting of the Parliamentary Bill to constitute a Ministry of Transport. As already indicated, it is expected that the Minister of Ways and Communications will take over the railway powers of the Board of Trade and all the functions of the Light Railway Commissioners, the Road Board, the Road Transport Committee, and the Commissioner of Waterways. It is probable that an attempt will be made by the motor car interests to have a separate Road Ministry.

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THE COMMITTEE ON TRANSPORT.

EVIDENCE ON TRAMWAYS AND LIGHT RAILWAYS.

In our issue of December 19 last an abstract was published of the report of the Select Committee of the House of Commons on Transport. It will be recalled that owing to the shortness of the time before the dissolution of Parliament it was impossible for the Committee to conclude their inquiry, and they accordingly did not present final recommendations on most of the points submitted to them. The scope of their investigation was indeed very wide, because they were appointed to consider what steps it is desirable to take to develop and improve the internal facilities of transport within the United Kingdom, to secure effective supervision and co-ordination, and to ensure that such development is adequate and suitable to meet the national requirements. The minutes of evidence taken by the Committee have now been published in a Blue Book. The witnesses included railway managers, representatives of Government Departments, traders and others, and their testimony related to a wide variety of subjects connected with railways, canals, road motor transport, and to a limited extent tramways and light railways. We here give a summary of the evidence in regard to tramways, light railways, and the trackless trolley system.

TRAMWAYS AND LIGHT RAILWAYS.

Sir William Marwood, joint permanent secretary of the Board of Trade, gave evidence as to the powers and action of that Board in matters of transport. In reference to tramways, he said that the Board can authorise tramways by Provisional Orders, which have to be confirmed by Parliament. About Provisional Order procedure there is a weakness, or what a company promoting a tramway consider to be a weakness, namely, they have to get the consent of two-thirds of the local authorities on the route, or otherwise they cannot even get their case heard. One result of that is that such tramway Provisional Orders as the Board now have are mostly promoted by local authorities in their own districts, or in some cases going a little outside, in which case they are subject to obtaining the consent of the outside authority. The other method is to proceed by a Light Railway Order, and quite a fair number of tramways have been made under that. Tramway people are not so keen as they used to be, because the life of a tramway track is not what they formerly thought it was, and most of the profitable routes are taken up.

In regard to motor omnibuses, they are a cheaper method of developing a new route than a tramway until a considerable traffic is secured, when the advantage would probably rest with the tramway in moving that traffic. He believed it is entirely a question of the amount of traffic to be moved.

The powers of the Board of Trade are a little wider on the subject of construction of tramways than in the case of railways, because they can decide the position of the tramway in the road, the position on the pavement of a post for overhead equipment, and such matters of public convenience. In certain circumstances the Board can authorise the kind of vehicle to be used on tramways. In the case of light railways they can approve the form of vehicle. On the inspection of a tramway before opening, if they thought the rolling stock unsuitable, they would not allow the tramway to be opened. When, however, a tramway is once opened he did not think the Board have any power. A tramway company, however, cannot run trailer cars without the Board's consent. The Board considered that question more or less on the ground of safety. The Board also have statutory power of revision of fares, but it is a power they are hardly ever invited to exercise. The Board can increase fares, but as he read the Act it is only after a reduction. The Board have never really had that matter argued out. He thought the provision meant that if the Board have reduced the fares on a tramway on an application by the local authority or by the public, and circumstances have altered, they can then raise the fares again, but he did not think they had ever done it.

CARRIAGE OF GOODS.

In regard to the carriage of goods, the model form of Tramway Act contains a prohibition against carrying anything except passengers and parcels, but that is not its effect. It appears in the model form because he supposed they had to put in something. A great many Tramway Orders and Acts have contained a provision empowering the undertakers to carry goods, and a schedule of rates. The result of that is that some tramway authorities can carry goods practically on any portion of their system, whereas other authorities may only carry goods on portions of their system. If you take Bradford, for instance, roughly speaking on half their lines the Bradford Corporation may carry goods other than parcels, but on the other half they may not, which effectually prevents the carriage of goods on any part except on a very short piece. In other cases there is perhaps no power to carry goods at all. In certain cases, as in Manchester, for instance, they do a considerable business in carrying parcels. They had some slight difficulty over expending capital for the collection and delivery of parcels. In fact, at one time the cartage interests in Manchester got an injunction against them, but they got round that somehow. In Leeds they carry bricks on the tramways; there they have power to carry goods, and there is a brickyard inside Leeds, and a short extension line was authorised to connect up with that brickyard, and a certain amount of traffic of that sort is carried. Most tramway authorities carry their own materials. This matter has come before the House of Commons this session, because Sheffield, who, generally speaking, have no power to carry goods on their tramways, applied to Parliament to consolidate their special Acts, and the procedure was rather curious, because in that Consolidation Act they included a power to carry goods, which was an amending and not a consolidating power. The matter was contested in the House of Commons, and the House of Commons has allowed the provision, but it is going to be raised again in the House of Lords.*

It would seem only reasonable that when you have lines laid down you should carry goods, but there is the effect of competition on the railway undertaking to be considered, and also to some extent the residential question. In Bradford, where they have been very deeply into this question, they had an idea of putting sidings from the tramways into the various works, and pushing ordinary railway wagons along and putting them into those sidings. That may be all very well in a busy road, but those living in a quiet street which had a tramway up it might find it a nuisance if they were working all night long after the ordinary time of running the tramways.

At the moment the Board of Trade said, and he had talked to Mr. Whitley about it, who was quite in agreement, that if the Board found it necessary for the purpose of the war, that goods should be carried on any particular tramway they would, under the Defence of the Realm regulations, overrule any particular prohibition, but they have not had any case of that sort before them. In the coming peace time it is an important subject which has to be considered and dealt with. Part of the consideration will have to extend to whether the Board of Trade should be vested with some regulative powers, or whether there should be general legislation. It would have to be considered whether there should be a general removal of the disability or whether some authority, say the Board of Trade, should consider the particular cases. There may be reasons in some particular cases making it undesirable to give the power, at least on portions of a tramway, or it may be desirable to limit the hours during which the power may be exercised. Pushing railway wagons up and down all night long might almost become a nuisance.

TRACKLESS TROLLEYS.

In regard to the trackless trolley system, Leeds and Bradford were the first two places to put the system in operation, and as an engineering matter it is quite a success. There are, however, different views as to the effect of it on the roads. Some people say it is so admirably elastic that the road is equally used; other people say that the want of elasticity causes the wheels to run in grooves. Either side can produce photographs of a remarkable character of roads on which trackless trolleys have been running. It is a subject worth considering, because there is a great saving in the initial cost.

The Board have no power to authorise a trackless trolley installation. They endeavoured to take power in 1912, when they had a small Act before Parliament for amending the Light Railways Act, but there was a good deal of opposition, and the Board got beaten in Grand Committee on it. The County Councils Association got up the opposition because several big towns were promoting trackless trolleys in the country districts. He thought that generally speaking the system is used for extensions and not so much for connecting up the ends of tramway systems. The idea was to put up the overhead installation, and when the traffic has developed sufficiently to warrant the expense of a tramway, the rails are to be put down, and the overhead equipment wants very little alteration. There is, or might be, much less damage to a road if tramlines are put down, because they strengthen the road, whereas if you have these rather heavy vehicles, the loaded weight of which is about 5 tons, roving about on the surface of the road, damage is done. That is the objection of the outside authorities. They would not have minded tramways so much.

In reference to light railways, the Light Railways Act of 1896 which was for the encouragement of railway enterprise, set aside £1,000,000 which might be advanced to assist in these enterprises, three-quarters of which could be advanced by way of loan in cases where local authorities were contributing, and a quarter of a million could be allowed by way of advance either as a loan or as a free gift. The Board make recommendations to the Treasury, and the advance is paid as the work goes on. In 1912 the amounts that might be given in loans or special advance was altered. A quarter of a million might be given on loan, and three-quarters of a million as a special advance. The Board inspect the lines before certifying. In the way of special advances the Board have actually paid about £200,000, and the amount authorised is £348,000.

With respect to the trackless trolley system, it has only been working very recently, and he did not think there is any very conclusive evidence as to what the cost of running trackless trolleys

* The power to carry goods was afterwards refused by a House of Lords Committee.

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is. Brighton wanted to run double-deck trackless trolley cars, but the Board of Trade objected to it. He did not think any undertaking does run double-decked trackless cars, either here or abroad.

In regard to the use of trailer cars, the Board of Trade have to be satisfied as to the brake, and the trailer is subject to their approval, but the principal thing is to get a brake which will work more or less automatically between the two cars, and he thought there is a very satisfactory brake.

Railways and Short-distance Traffic.

Sir Francis H. Dent, general manager of the South Eastern and Chatham Railway, asked whether his company had considered the question of local traffic after the war, said that on the South Eastern and Chatham Railway, even before the war, short-distance traffic did not pay working expenses, and it did not contribute a penny towards the overhead charges. The difficulty which the South Eastern and Chatham Railway were in was that they, at very great expense in the early days of railways, constructed a means for bringing suburban people into London. It was not the right means; the right means for bringing people into London from short distances was by tramway. It took London a long time to realise the necessity for a system of electric tramways, and now that they have got that system, the paying part of the traffic goes to the tramways and the railway company are left with the unpaying part of the traffic—that is, the rush in the morning and the evening. The real way of carrying that traffic is by tramway, and the railway company are in the unfortunate position that they made that accommodation which is not now wanted. Electrification of the railway local traffic would increase the capacity, but it does not reduce the cost.

London Traffic.

Sir William Marwood, asked as to the principal recommendation of the Royal Commission on London Traffic, thought there should be a Traffic Board. The recommendation was not acted upon, as nobody could agree as to the constitution of a Traffic Board. The Board of Trade set up their traffic department mainly to keep going certain work that had been done by the Royal Commission on Traffic, such as keeping records, viewing the position, and making recommendations which local authorities might give effect to. The Traffic Branch came to an untimely end; the war came and led to its termination.

DEVELOPMENT OF INDUSTRIES.

The Case of the Electrical Trades.

There was issued towards the end of January the report of the Engineering Trades (New Industries) Committee, which was appointed by the Ministry of Reconstruction in December, 1917. The instructions were to compile a list of the articles suitable for manufacture which were either not made in the United Kingdom before the war but were imported, or were made in the United Kingdom in small or insufficient quantities, and for which there is likely to be a considerable demand after the war. The Committee were also to make recommendations on the establishment and development of such industries by the transfer of labour and machines and otherwise, and as to how such a transfer could be made and what organisation would be requisite. The Committee set up 15 branch committees, each to give detailed consideration to groups of articles, and consisting of representatives of the trades concerned.

In their general observations the committee say that many engineering firms are threatened with serious financial trouble unless steps are promptly taken to finance payments due by engineering firms to the inland revenue in respect of munitions levy and excess profits tax. It is assumed confidently by the Committee that the excess profits tax will be removed as soon as possible; if it were not so removed there would be small likelihood of firms undertaking the risks inseparable from the starting of new industries. It is also the view of the Committee that the manufacture of many articles could not be successfully undertaken in this country by commercial enterprise alone, and it would therefore be necessary that some form of assistance should be given towards overcoming the difficulty of competition. It is clear to the Committee that in some branches of the engineering trades the industry has not kept pace with the up-to-date requirements of customers. The principal remedies for this state of affairs are specialisation and standardisation.

Another point to which the Committee draw attention is that manufacturing engineers were to some extent prevented from developing their businesses on proper lines by the personal fads and fancies of engineers in official positions, and by the practice among consulting engineers of insisting on individual designs. The result has tended to relegate our workshops to the manufacture of non-standard products. In Germany and the United States the more general practice has been for buyers to specify broadly what they wanted, and to leave the details to be worked out by the manufacturers, who thereby were allowed to develop on right lines and become more efficient, and the industry therefore was placed in a better position to do a world's trade.

In regard to labour conditions, the Committee recommend that a new industry should not be introduced into this country unless a wage should be paid to those employed in it which would ensure an adequate standard of living, and unless machinery is provided for regulating wages and hours of labour.

Among the branch committees whose reports are appended to the general report is the branch committee on electrical apparatus and machinery. This Committee considered a list of 60 articles, and were satisfied that the majority of them cannot correctly be described as not made in the United Kingdom or were made in small or insufficient quantities. The existing ample facilities were not, however, fully employed owing to the importation of articles from abroad.

Certain items, however, appeared rightly in the list, and as a result of the activities of the Committee, intimations have been received of intention to undertake the manufacture of the following articles:—Car lighting sets, car starting sets, electric truck and vehicle motors, fans, motors (small, ½ H.P. and less), small portable electric drills, small portable electric grinders, buffers, and polishers.

Certain articles appeared in a preliminary list which should be treated separately, these being carbons, insulating materials, magnetos, porcelain, glassware, and sparking plugs. As to carbons, measures should be taken by the Government to ensure the continuance of the industry. In regard to insulating materials, an enormous amount of research work is necessary, and manufacture in this country cannot be successfully established without State assistance and support. Many firms are preparing for increased production of insulating materials. The development of this industry is absolutely essential to the ultimate success and permanency of the British electrical manufacturing industry. The Committee recommend that electrical manufacturers should purchase only British-made insulating materials where obtainable.

Magnetos are now adequately made in this country, and the exclusion of German magnetos is recommended for a period after the war except under licence, together with a duty on all imported magnetos.

Co-operation has been established between porcelain manufacturers. Glass for arc lamps came exclusively from Germany and Austria. The method of manufacture of heat-resisting glass was practically unknown in the United Kingdom before the war. Since then some progress has been made, but it is represented to the Committee that unless Government support is forthcoming glass manufacturers will not be in a position to supply arc lamp glasses in sufficient quantities. The manufacture of sparking plugs should be encouraged.

The development of electric power will in all probability cause a demand for extra high tension switchgear for working pressures of 25,000 volts and upwards. The fact that such switchgear has not yet been manufactured on a commercial scale in the United Kingdom has led public authorities to place their orders for such gear abroad, usually in Germany or the United States, on the grounds that the work must be given to a concern which has "successfully done similar work before." British manufacturers of switchgear should be encouraged, because they have the capacity for such work.

The development of the electrical industry in Great Britain was hampered by stupid repressive legislation. Further, to prevent this country from developing the home industry, and obtaining its due share of overseas trade, foreign competitors deliberately tried to strangle the industry. The free importation into this country of manufactured goods has always formed a very serious hindrance to the development of the industry. Foreigners, operating in their own home markets, protected by tariffs and fostered nationally, produce on a far larger scale than the British manufacturer. In such conditions the industry cannot be expected to thrive. The Committee find that it is essential to establish confidence in the future of the industry by assuring it the support of the home market, without which it is hopeless to expect any great development. The Committee passed a resolution declaring that the electrical producers of this country are entitled to receive from the Government protection in the home markets against dumped and sweated goods.

In the event of the Government adopting the recommendations of the Electric Power Supply Committee's report (in favour of a national power supply), the present branch committee recommend the establishment of a permanent advisory council. This council should be mainly composed of leading British electrical engineers engaged in actual manufacturing. The council should be consulted in the first instance with regard to the gentlemen it is proposed to appoint as Electricity Commissioners, and should continue as a standing advisory council to the Electricity Commissioners, with a view to ensuring that national development and progress are in conformity with the latest workshop methods of quantity production.

The members of the branch committee on electrical machinery and apparatus are Messrs. John Taylor, O.B.E. (chairman); Herbert Taylor, (hon. sec.), Mather and Platt, Limited; L. D. Atkinson, Cable Makers' Association; A. F. Berry, British Electrical Transformer Company; R. Dumas, British Thomson-Houston Company; G. E. Pingree, British Thomson-Houston Company; D. N. Dunlop, British Electrical and Allied Trades Association; B. Longbottom, Electromotors, Limited; R. H. Schofield, Ferranti, Limited; S. D. White, General Electric Company; and F. Hird, Siemens Brothers and Company.

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THE ELECTRICAL INDUSTRIES AND THE POWER SUPPLY SCHEME.

The latest authoritative expression of competent opinion on the reports of Government Departmental Committees on the provision of a national electric power supply is contained in the following report sent to the President of the Board of Trade by a representative committee formed by the Institution of Electrical Engineers. The view is maintained that the functions of the proposed Board of Electricity Commissioners should be exclusively judicial and advisory, and that private enterprise should be given large scope.

(1) On June 27, 1918, the Council of the Institution of Electrical Engineers took into consideration the reports of the committees appointed by the Board of Trade on Electric Power Supply (Cd. 9,062) and Electrical Trades after the War (Cd. 9,072)

(2) These official reports embody recommendations leading to drastic revisions of the conditions under which the electrical supply industry had been carried on in Great Britain.

Recognising that the future course of development in electricity supply for industrial and domestic purposes, in electric traction, in electrical manufacturing, and in many other branches of electrical business, depended on the character of the legislation based upon these reports, the Council were convinced that the Institution of Electrical Engineers, as the body including and representing those engaged in all sections of the electrical industry, should endeavour to obtain and collate the opinions of these sections on the fundamental issues involved.

In view of the vital importance of a cheap and abundant supply of electricity to the engineering and other industries, the Council decided to form a special committee, and to include therein representatives of the most important consumers of electric power.

(3) Each of the following bodies was invited to nominate two representatives, who, with the president and four vice-presidents of the Institution of Electrical Engineers acting *ex-officio*, would constitute the committee :—

The British Electrical and Allied Manufacturers' Association, The Association of Consulting Engineers, The Federation of British Industries. The Cable Makers' Association, The Incorporated Association of Electric Power Companies, The Provincial Electric Supply Committee of the United Kingdom, The Tramways and Light Railways Association, The British Electrical Federation, Limited, Edmundsons' Electricity Corporation, Limited, The Iron and Steel Institute, The Conference of Directors of the London Electric Supply Companies, The Electrical Contractors' Association, The Incorporated Municipal Electrical Association, The Association of Municipal Corporations.

(4) At a preliminary meeting of the committee held on July 29, 1918, it was agreed that each association represented should give separate and independent consideration to the reports of the two Board of Trade Committees, and should draw up their recommendations as to the main lines which future legislation should follow. The Incorporated Municipal Electrical Association and the Association of Municipal Corporations had, however, decided to submit separate reports to the Board of Trade, and were not represented on the committee.

(5) The reports of the remaining associations were duly prepared and laid before the committee, after having been adopted in most cases by the respective Councils of the associations. They accordingly embody the considered opinions of the accredited representatives of several large groups of electric supply undertakings, the great majority of electrical manufacturers, consulting engineers, and the most important users of electric power for industrial purposes in Great Britain.

(6) Some of the reports were less detailed than others, and it is therefore not possible to present a combined opinion upon all the matters dealt with by the two committees of the Board of Trade. On no point of primary importance, however, is any material difference of opinion displayed. Substantially on the main issues relating to present electrical legislation the various associations showed an impressive unanimity.

(7) The following views and recommendations in regard to electric power supply more particularly are therefore presented as expressing the united convictions of the committee, and through them of the many sections of industry which they represent :—

(*a*) The restrictive conditions embodied in the Electric Lighting Acts, the Tramways Act, the Light Railways Act, and the various Acts relating to electric power supply have had a most detrimental effect on electrical progress in Great Britain. This legislation has led to the multiplication of small, arbitrary, and uneconomical areas of electricity supply and systems of electric traction ; it has discouraged the investment of capital in electrical undertakings by imposing limited tenure with unattractive terms of expropriation and various other onerous conditions ; it has placed obstacles in the way of grouping undertakings into comprehensive systems of supply and transport ; it has, generally, prevented British electrical engineers and manufacturers from realising in their own country the highest achievements of which their technical skill and productive capacity were capable, and it has in consequence put them under a serious handicap in the competition for export business against countries in which the conditions have been more favourable for successful commercial demonstration.

(*b*) The evil effect of past legislation, emphasised so strongly by both the official reports, necessitates drastic reform of the enactments referred to, both in the spirit and the letter, if the industry is to fulfil its function of providing cheap and abundant electricity for industrial, agricultural, and domestic purposes, and for the development of electric traction on railways, light railways, and roads.

(*c*) In addition to releasing electrical enterprises from the existing disabilities, the chief necessities of the situation are (1) the treatment of the problem of electrical generation and distribution on broad lines, and (2) the provision of simple forms of procedure in obtaining powers for electrical utilities.

(*d*) In order to secure these and other essentials of ordered progress, the appointment of a Board of Electricity Commissioners is welcomed subject to the provisions expressed below.

(*e*) The Committee are strongly convinced that, owing to the complexity of the technical, administrative, and financial problems involved in a comprehensive scheme of electric supply reform, it will be found altogether impracticable to deal directly with the task of reconstruction by means of general legislation covering all the points at issue. They accordingly urge that immediate action should be confined to the creation of the Board of Electricity Commissioners, who should have powers and functions as outlined in the following paragraphs. There should be a gradual development in the establishing of the administrative machinery as the necessity is felt, otherwise the industry may be hampered in the future by excessive organisation, to the same extent as it has been in the past by the conditions referred to.

(*f*) This board should be a tribunal of skilled men, free from political influence, charged generally with the duties of (1) examining all proposals for the extension and consolidation of existing electrical enterprises ; (2) recommending to the Board of Trade and to Parliament, for authorisation, schemes which are on the soundest financial and engineering lines, and (3) advising the Government on legislative matters for the encouragement of the electrical industry.

(*g*) The functions of the board should be exclusively judicial and advisory. Strenuous objection is urged against the granting to the board of administrative powers over electrical undertakings, and also of authority to appoint District Boards in the event of such bodies being constituted. In this respect the powers of the Commissioners should be limited to examining schemes brought before them for dealing with the various districts.

(*h*) The preparation of such schemes, whether company, municipal, or joint, should be left as a matter of free and natural development to the initiative of undertakers who would formulate such schemes (it may be rival schemes) and put them forward for the consideration of the Commissioners, who would report to Parliament upon any Bills intended to carry them into effect. Opponents would be entitled to be heard against such Bills in the usual way.

(*i*) The board may be empowered to deal with the electrical rules and regulations administered by the Board of Trade and the Home Office, and it may also act as arbitrator and as a Court of Record for the electrical industry.

(*j*) The Railway and Canal Commission is suggested as a general model for the constitution and powers of the board.

(*k*) The number of Commissioners on the board should be five, and in all cases the appointments should be permanent, or for long periods, and should be on such conditions as will attract men of the highest ability, knowledge, and independence. One member should be skilled in legal affairs and in sifting evidence, one in finance, one in the problems of electrical manufacture, and the others with experience in engineering and the management of electrical undertakings.

(*l*) While in the main the work of the board will consist of formulating the principles of procedure in the course of electrical progress, and of recommending the legislative amendments and the specific schemes which are in agreement with these principles, it may be necessary in some cases for the board to propose the enforcement, by Parliamentary authority, of arrangements for interconnection or amalgamation of supply undertakings.

(8) Recommendations have been made by various associations represented on the Committee regarding specific matters dealt with in the reports of the two Board of Trade Committees, but it is felt that these problems will receive a satisfactory solution as a result of the formation of an independent authoritative Board of Electricity Commissioners, which is the crucial matter at this stage

I am directed respectfully to urge on behalf of the committee that legislation adverse to the views of the large proportion of the industry and of the consumers which the committee represents may not be introduced without their being accorded an opportunity of discussing the matter with you.

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AN "ARMISTICE" CAR ON PARA TRAMWAYS.

We are indebted to Mr. Walter Binns, manager of the Para Electric Railways and Lighting Company, Limited, for the photograph which is reproduced on this page of the company's car in the procession which took place in Para on December 1, the day appointed for the celebration of the armistice. The procession was an imposing one, the cars being excellent reproductions representing the various allied countries, the greatest impression being created by "our car," representing England, which consisted of a model of H.M.S. *Glasgow*, the favourite warship on the South American station, renowned for the part she played in the Coronel and Falkland battles.

The model was constructed on one of the company's freight cars, and was manned by a crew of some forty persons, including a number of Englishmen and several Brazilian maidens dressed in costumes representing the different colonies of the Empire, with Britannia sitting aloft holding trident and shield. It was only becoming that the cruiser should have some worthy representatives of Scotland on

board, and at the bow, in charge of the forward turret, was Mr. Burnet, of Lenzie, formerly in the service of the Glasgow Corporation, and now with the Para Electric Railways Company, and on the after deck, Mr. Thomson, of Glasgow, is seen standing as John Bull with his dog. Amidships, Mr. Kay, of Dundee, represented Tommy Atkins. Mr. Binns, in white, is seen standing just by the stern.

The car created a great impression, being generally voted as the finest representation in the procession. At frequent intervals during the march of the procession through the city, salvos were fired from a small cannon in the bow, controlled by Mr. Burnet, and at night-time the cruiser was outlined with electric lamps, making a truly unique spectacle.

In Brazil, as no doubt in many other countries, the part which this country has played during the war is very imperfectly understood, and Britishers in Para took the opportunity to impress upon the people the all-important part played by the British navy in the war.

Mr. John Wiseman, secretary to the Edinburgh and District Tramways Company, died suddenly on February 6 from pneumonia.

MANUFACTURE OF MUNITIONS.

Work of the London County Council Tramways Department.

The London County Council, on December 17, passed a resolution of thanks to members of the staff in the tramways department engaged during the war on work in connection with the manufacture of munitions.

A report of the Highways Committee gave some particulars of the work done during the past three and a half years in the tramways department in the manufacture of munitions. In June, 1915, the Council placed its resources at the service of the Ministry of Munitions and the Metropolitan Munitions Committee, but certain assistance had been given by the tramways department since the early part of 1915. The services rendered consisted of the loan of technical officers and the manufacture and examination of munitions, etc.

The work performed was of a very varied character, but the efforts of the department were mainly concentrated on the manufacture of gauges of all sizes for field guns, howitzers, naval guns, tanks, munitions, etc. About 18,300 gauges were delivered and passed, and in addition 506 gauges in course of manufacture on the conclusion of the armistice have been taken over by the Government. Steps had also been taken to render assistance in the manufacture of screw gauges, but the work was suspended on the cessation of hostilities. Other classes of work executed included the manufacture of 7,725 high explosive shells, the banding of 36,039 shells, the manufacture of 214 height measuring apparatus for aircraft work, 30,300 steel rings for adapters, shell forging callipers, rumbling drum machines, trucks for carrying fulminate, light trolleys, and test pieces. The whole of the necessary alterations to existing plant and the new boring bars and other tools necessary to undertake the manufacture of shells was entirely carried out by the department.

From time to time expressions of appreciation have been received both orally and in writing, with regard to the assistance rendered to the Government by the prompt and efficient manner in which urgent and intricate work has been carried out, concluding with a letter from the director of munition gauges, expressing the appreciation of his department for the perseverance shown in surmounting the great difficulties which had to be overcome in connection with the work.

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THE ENGLISH ELECTRIC COMPANY.

EXPANSION OF DICK, KERR AND COMPANY.

Much interest is being taken in electrical manufacturing and traction circles in the fact that the arrangements foreshadowed by the chairman at the annual meeting of Dick, Kerr and Company, Limited, on December 19 last, are now being carried out. We have referred briefly to the scheme in former issues, and we understand that the plan for the fusion of interests is proceeding satisfactorily. The particulars of the scheme were set out in circulars issued to the shareholders. The new company which is being formed is entitled the English Electric Company, Limited. This company, whose offices are at Abchurch Yard, Cannon Street, London, E.C., has acquired a controlling interest in the Coventry Ordnance Works, Limited, and the Phœnix Dynamo Manufacturing Company, Limited. An offer is made to the shareholders in Dick, Kerr and Company to exchange their shares, ordinary or preference, for an equal number of similar shares in the English Electric Company. The shareholders accepting the offer have been given the right to subscribe at par for one ordinary share of £1 in the new company for every three shares, ordinary or preference, exchanged. The English Electric Company has a nominal capital of £5,000,000 (£1,500,000 preference and £3,500,000 ordinary), and as the transfer of shares in Dick, Kerr and Company would absorb only £2,000,000 of this capital, it is evident that the directors have important developments in view.

The first directors are:—

C. T. Cayley, 5, Portland Place, W. (chairman of Dick, Kerr and Company).
B. A. Firth, Norfolk Works, Sheffield (chairman of Thomas Firth and Sons).
W. Rutherford, 3, Abchurch Yard, E.C. (managing director Dick, Kerr and Company).
J. Sampson, 8, The Sanctuary, Westminster, S.W. (director of John Brown and Company).
P. J. Pybus, Thornbury, Bradford (managing director of Phœnix Dynamo Company).
Colonel J. H. Mansell, The Chace, near Coventry (managing director, Coventry Ordnance Works).
A. Gracie, Fairfield Works, Glasgow, engineer.
W. L. Hichens, 3, Central Buildings, Westminster, S.W. (chairman of Cammell Laird and Company).
C. E. Ellis, Rampton Manor, Notts, manufacturer.

The board is thus a particularly strong one, and representative of the leading engineering industries. Three large railway companies are represented by Sir Charles Ellis for the Great Eastern Railway, Mr. W. L. Hitchens for the London and North Western Railway, and Mr. B. A. Firth, for the Great Northern Railway, while Mr. John Sampson, a director of Messrs. Harland and Wolff, Limited, and Sir Alexander Gracie, of the Fairfield Shipping and Engineering Company, represent shipbuilding and owning interests. The joint managing directors are Lieut.-Col. J. H. Mansell, Messrs. P. J. Pybus and W. Rutherford.

RESIGNATIONS FROM ROAD BOARD.

Sir George Gibb has resigned the salaried post of chairman of the Road Board, which he has held since its formation in 1910. He is, it is added, accepting the position of consulting general manager of the North Eastern Railway, of which he was solicitor for many years and general manager from 1891 until 1906.

Mr. Rees Jeffreys has resigned the secretaryship of the Road Board to accept the position of financial adviser to the Motor Union Insurance Company, Limited, of which he was one of the founders and original directors. He has also been elected chairman of the Federated British Insurance Company, Limited.

Mr. Rees Jeffreys, as reported in another column, is now acting as chairman of a representative committee who are drafting a Bill for a Traffic and Development Board for London and the Home Counties. At the request of the Demobilisation Committee he prepared the road programme for 1919-1920.

Stephen Sellon and Partners.—We are informed that Mr. Stephen Sellon's practice will be continued by Messrs. Arthur R. Hoare and S. Rutter Fletcher, both of whom have been associated with Mr. Sellon for the past twenty years, with the same firm name and at the same address (36, Victoria Street, London, S.W.1).

Mr. C. H. Wordingham, C.B.E., who since 1903 has been head of the electrical department of the Admiralty, and as such responsible for the design and supervision of the construction and completion for service of the electrical equipment of all H.M. ships, as well as for advising on all important questions of electric lighting and power in connection with dockyards and other naval shore establishments, has resigned his appointment as director of electrical engineering in order to return to consulting practice. His address is now 7, Victoria Street, Westminster, S.W.1. Mr. Wordingham has been retained by the Admiralty to continue acting in an advisory capacity.

CONTRACTS AND ORDERS.

The Rail Welding Company, of London, have received an order for the repair of 250 tramway rail joints from the Heywood Electricity and Tramways Committee.

Bradford Tramways Committee have accepted tenders from Hadfields, Limited, for cast and steel crossings, and for copper bonds from the Britannia Lamp and Accessories Company.

New Shelters at Dudley.—The Corporation have accepted the tender of Bayliss, Jones and Bayliss, Limited, for ironwork, and of Messrs. Round and Son, for woodwork required for the erection of four tramway shelters.

Dick, Kerr and Company, Limited, recently secured a contract for the supply of a 3,000 KW. 3,000 revolutions per minute turbo-alternator set, together with condensing plant, to Cammell Laird and Company, Limited. The turbine will be of the Willans-Zoelly type, to operate on steam at 160 lb. pressure, superheated to 650 deg. Fahr., and the condensing plant of the surface type, with the Willans rotary system of air extraction, the circulating ejector and extraction pumps being driven by an auxiliary turbine which will exhaust into a feed-heater. The turbo-alternator, by Messrs. Siemens Brothers and Company will supply three-phase current at 3,300 volts, 50 cycles, and will be fitted with an overhung exciter.

FINANCIAL REPORTS AND MEETINGS.

CROMPTON AND COMPANY, LIMITED.—An interim dividend at the rate of 7 per cent. per annum for the six months ended September 30 last has been declared.

BLACKPOOL, ST. ANNE'S AND LYTHAM TRAMWAYS COMPANY.—During the past year this undertaking carried over eight million passengers. The receipts were £63,620, and the available balance was £10,347. Debenture interest requires £7,500 and £1,500 is carried to the sinking fund. There is an adverse balance of £39,084.

PROVINCIAL TRAMWAYS COMPANY.—Presiding at the annual meeting of the Provincial Tramways Company, the chairman, Mr. A. Beattie, said that the past year was the best in the history of the company. They had been working under great difficulties and the cost of materials had increased considerably, while wages had also risen, but very satisfactory results had been obtained without an increase of fares.

LIVERPOOL OVERHEAD RAILWAY COMPANY.—A final dividend for the half year ended December 31 last has been declared at the rate of 5 per cent. per annum, less income tax, on the preference shares, and 4 per cent. per annum on the ordinary shares, making the rate for the year 5 per cent. on the preference shares and 3½ per cent. on the ordinary shares.

SOUTHPORT TRAMWAYS.—The results for the 12 months ended March 31, 1918, show that the traffic revenue, which amounted to £23,875, was a record for the undertaking. The gross profit of £10,263 is also a record. Owing to the payment out of net revenue of expenses incurred in the purchase of the Southport Tramway Company's undertaking and of war allowances amounting to £334 there is, however, a net loss of £103.

YORKSHIRE (WEST RIDING) ELECTRIC TRAMWAYS COMPANY, LIMITED.—For the year ended December 31, 1918, the traffic and other revenue aggregated £140,568. After providing for debenture interest and making provision for deferred repairs, there is a net income of £15,303. Adding the amount brought forward from last year, viz., £20,609, the available balance is £35,912. This sum has been appropriated as follows:—Dividend at 6 per cent., less income tax, on cumulative preference shares, £9,888; purchase of funded preferential dividend certificates, £11,187; renewals, depreciation and reserve fund, £12,311; balance carried forward, £2,526.

AYR CORPORATION TRAMWAYS.—The report of the general manager Mr. William Grant, for the year ended May 15, 1918, states that the total receipts amounted to £24,562 and the working expenses to £14,416, leaving a gross profit of £10,146. After payment of interest and sinking fund charges, and making allocation to the depreciation and renewals fund of £2,547, the sum of £2,118 was transferred to the general borough assessment. The revenue was the highest ever received. The traffic receipts were £23,318, an increase of £3,562. The receipts per car-mile were 13·37d., as against 11.79d. Passengers increased by 12·81 per cent. The energy consumption was 1·14, or an increase of ·06 units per car-mile, which is attributed largely to the indifferent driving by some of the women. The working expenses, including power costs, were 8·26d. per car-mile, and the percentage of working expenses to receipts 58 per cent. In view of the continued increases in working expenses, halfpenny fares were abolished and fare stages readjusted in April last.

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UNDERGROUND ELECTRIC RAILWAYS.—The directors of the Underground Electric Railways Company of London state that, subject to confirmation of the dividend announcements by the companies in which the company is interested, the revenue of the company will enable it to pay the interest to December 31 last on its 6 per cent. first cumulative income debenture stock, and to pay the full interest of 3 per cent., free of income-tax, on its 6 per cent. income bonds of 1948 for the half-year ended December 31, with a carry forward of £36,700. A year ago the payment on the 6 per cent. first income debentures was at the same rate, but that on the 1948 income bonds was 4 per cent. for the year.

DUBLIN UNITED TRAMWAYS COMPANY.—The report for the year ended December 31, 1918, is summarised below in comparison with the three preceding years. The amount available for division at December 31 last was £117,493. Interim dividends amounting to £22,620 were paid in August last, leaving a balance of £94,873. The directors recommend a dividend of 6 per cent. per annum, less income-tax, on the preference shares for the half-year, and a final dividend at the rate of 6 per cent. per annum, less income-tax (making 5 per cent. for the year) for the half-year, together with a bonus of one shilling, free of income-tax, per £10 unit of ordinary stock, setting aside £35,000 towards deferred renewal of rails and cars, and adding £15,000 to the general reserve fund. These appropriations, together with £1,850 to be written off the price of investments, bringing them to their present market value, absorb £104 230, leaving £13,263 to be carried to the next account.

	1918.	1917.	1916.	1915.
	£	£	£	£
RECEIPTS—				
Traffic receipts	443,401	353,838	319,612	317,762
Parcels delivery	7,725	7,313	6,987	7,467
Advertisements	3,742	3,697	3,980	4,143
Carriage of goods	3,635	2,361	2,094	1,874
Other receipts	2,653	2,727	2,662	2,653
Total receipts	461,156	369,936	335,335	333,899
EXPENSES—				
Working and general	310,946	243,152	213,587	201,836
National insurance	877	900	915	961
Repairs to cottages	1,454	1,387	1,191	1,235
Parcel delivery	6,364	5,146	4,143	4,400
Goods carriage	2,293	1,366	1,025	951
Total expenses ...	321,934	251,951	220,861	209,383
Balance on working	139,222	117,985	114,474	124,516
Balance from last account ...	13,461	13,359	13,045	11,366
Interest	2,842	1,636	1,650	1,902
Total balance	155,525	132,980	129,169	137,784
DEDUCTIONS—				
Interest on debentures	20,490	21,496	22,868	25,421
Wayleaves	11,247	11,798	12,107	13,518
Payment to Howth Co. ...	3,000	3,000	3,000	3,000
Renewals, etc.	3,295	450	—	—
	38,032	36,744	37,975	41,939
Balance available for division ...	117,493	96,236	91,194	95,845
Div. on Pref. shares, 6 per cent. for year	25,650	27,000	27,900	31,200
Interim div. on Ord. shares for half-year	9,570 (4% p. ann.)	9,900 (4% p. ann.)	10,560 (4% p. ann.)	14,781 (5% p. ann.)
Final div. on Ord. shares ...	13,860 (6% p. ann.)	12,375 (5% p. ann.)	12,375 (5% p. ann.)	13,819 (5% p. ann.)
Bonus on Ord. shares	3,300	—	—	—
Reserve for renewals of permanent way	35,000	15,000	20,000	18,000
Reserve and renewals fund ...	15,000	7,000	7,000	5,000
Balance to next account ...	13,263	13,461	13,359	13,045
Written off investments ...	1,850	11,500	—	—
	117,493	96,236	91,194	95,845
Car mileage	6,787,654	7,732,897	7,440,614	7,881,938
Energy consumption	12 303,241	14,062,350	13,007 405	13,277,831

BRADFORD CORPORATION TRAMWAYS.—The report for the year ended March 31, states that the increase of traffic has been very great. The traffic revenue (excluding railless system) amounted to £366,495, as against £326,406 in the previous year, an increase of £40,089. Notwithstanding a decrease in car mileage of 194,124 or 3·38 per cent., the revenue has increased 12·28 per cent., which has had the effect of raising the receipts per car mile from 13·674d. to 15·892d. The expenditure has increased £45,253. Allowances to dependants of employees total £22,231, an increase of £7,880. There have been increases in traffic expenses owing to increases in wages and bonuses and the high cost of material. The cost of labour has risen to 61·75 per cent. of the total expenditure and 48·3 per cent. of the total income. The necessity of building up a reserve fund to meet the position after the war is emphasised. The total revenue (excluding bank interest, rents, etc.) amounted to £402,181, as compared with £356,025. Car mileage (excluding railless) was 5,534,858, as against 5,728,982; but notwithstanding this, there was a large increase in the number of passengers carried, the figures being 84,129,252 as against 77,074,546. The average number of journeys per head of population served was 227 as compared with 208. In connection with the through running between Bradford and Leeds, 662,570 through passengers had been carried in both sets of cars during the year. The income of the parcel traffic department shows a substantial advance, being £13,023, as compared with £11,729.

	1918	1917	1916	1915
	£	£	£	£
Income—				
Traffic revenue	366,495	326,406	314,486	305,005
Traffic, railless system	12,249	10,705	8,780	4,316
Sundry receipts	23,437	18,914	18,358	20,567
Total Income	402,181	356,025	341,624	329,888
Expenditure—				
Traffic expenses	122,129	105,109	92,158	89,470
General expenses	41,631	39,456	37,408	34,106
Repairs and maintenance ...	68,723	50,277	58,475	61,606
Power expenses	54,448	53,737	54,156	52,938
Miscellaneous expenses	5,836	4,529	4,416	5,191
	*292,767	253,108	246,613	243,311
War allowances	22,231	14,352	8,338	2,784
	314,998	267,460	254,951	246,095
Balance carried to net revenue ...	87,183	88,565	86,673	83,793
Interest, etc.	2,266	1,167	1,400	2,812
	89,449	89,732	88,073	86,605
Deductions—				
Interest	21,553	20,256	21,174	22,087
Income tax	10,193	10,693	7,987	5,422
Rents, leased lines	3,502	3,693	4,033	4,203
Net profit	54,201	55,090	54,879	54,893
Appropriated as follows:—				
Repayment of loans	—	—	1,003	1,003
Sinking fund	22,825	24,289	24,106	21,448
Relief of rates	10,000	3,400	25,000	10,000
Maintenance, etc.	116	1,924	233	7,832
Reserve fund	21,260	25,477	4,537	14,610
	54,201	55,090	54,879	54,893
Mileage of track	108½	108½	108½	108½
Car mileage	5,905,356	6,086,770	6,199,582	6,194,057
Units per car mile	2·101	2·018	1·990	1·900
Traffic receipts per car mile ...	15·892d.	13·674d.	12·842d.	11·816d.
Power cost per car mile	2·297d.	2·200d.	2·165d.	2·027d.
Traffic revenue per mile of single track	£3,484	£3,002	£2,892	£2,807
Expenses per car mile	12·322d.	10·063d.	9·450d.	8·774d.
Passengers carried	84,129,252	77,074,546	74,082,612	70,077,271
Fare per passenger	1·079d.	1·049d.	1·047d.	1·059d.
Ratio of expenses	78·32%	75·12%	74·63%	74·60%
Number of cars	233	234	236	252

* A loss of £513 on the Railless system is included in the working expenses.

COVENTRY TRAMWAY EXTENSIONS.

SCHEME FOR MOTOR OMNIBUSES LATER.

The City Council have adopted important recommendations of the Tramways Committee, which are based on a long and interesting report prepared by the general manager, Mr. T. R. Whitehead. Application is to be made to the Board of Trade for consent to important extensions and to borrow £333,616. This amount is the estimated cost of the work at pre-war rates, plus 75 per cent. The plans include the reconstruction and part doubling of certain lines, the reconstruction and extension of several other lines, twenty new cars, new car sheds, alterations to certain buildings, and the provision of a motor wagon.

Mr. H. W. Wale, chairman of the Tramways Committee, in submitting the report, said that the committee had in view not only the present needs but prospective requirements, and before coming to a decision they had looked closely into the question of what was the most suitable form of traction to employ in Coventry, and having regard to the peculiar traffic requirements, he was strongly of opinion that a motor omnibus service could not carry the traffic. He dwelt on the greater carrying capacity of tramway cars as compared with motor omnibuses. If the latter were used, 40 per cent. more vehicles would be required. At one point in the city at a particular hour seventy cars passed, and it was estimated that to deal with the same traffic, ninety-two omnibuses would be required. Examining the cost of tramways versus omnibuses, the chairman said the comparison was unfavourable to the petrol-driven vehicle, and in coming to a decision with regard to a motor omnibus service on present routes, the committee were of opinion that the tramway car was the best system of transport, although omnibuses would be a valuable adjunct. Later they would probably submit a scheme for the use of omnibuses as feeders.

Proposed Maidstone Extension.—Maidstone Town Council have passed a resolution to engage Mr. C. C. Hawtayne as consulting engineer in place of the late Mr. Stephen Sellon, and to instruct him to report on proposed extensions of the light railways in North and King Street Wards and to Chatham. It was mentioned that it would not be possible to begin the work of construction for two years, and that by that time the cost would probably be less than if such construction were carried out now.

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PERSONAL.

Mr. R. O. Baldwin, general manager of Exeter Corporation tramways, has been granted an increase of £50 in salary.

Mr. C. O. Silvers, general manager of Wolverhampton Corporation Tramways, has been granted an increase in salary to £600 per annum.

Mr. D. H. Davies, borough electrical engineer and tramways manager of Heywood, has been granted an increase in salary of £50 per annum.

Sergeant-Major W. Duddington, South Shields Corporation Tramways, has been awarded the D.C.M., and has been twice mentioned in despatches.

Mr. W. A. Toppin, assistant electrical engineer of Chesterfield Corporation, succeeds Mr. Acland in charge of the electricity and tramways departments.

Mr. Charles W. Hill has been demobilised from the Navy and has resumed his position of director of Messrs. Scholey and Company, Limited, of 56, Victoria Street, Westminster, S.W.

Lieut.-Col. Morrison Bell has been appointed to represent the London County Council at the annual conference of the Municipal Tramways Association, in the place of Mr. A. H. Scott.

Mr. A. Toms, London sales manager of the J. G. Brill Company, has been released from Government service and has now resumed duties at the London office of the company, 110, Cannon Street, E.C.4.

We regret to learn that **Mr. J. M. McElroy,** general manager of the Manchester Corporation Tramways, who has for some time been in ill-health, will not be able to resume his duties for several months.

Mr. W. MacGibbon, who has recently been appointed manager of the Mexborough and Swinton Tramways, will retain also the management of the Dewsbury and Ossett Corporation and Soothill Nether Urban District Council Tramways.

Mr. H. C. Babb, resident engineer for the past three years at Bo'ness electricity works, has been appointed general manager of the Musselburgh and District Tramways and Lighting Company. Mr. Babb entered upon his duties on February 1.

Sir Guy Granet, late general manager of the Midland Railway, advised the Government to undertake the construction of the Channel ferries at Sandwich and Southampton while he was acting as director in charge of movements at the War Office.

Mr. A. L. C. Fell, general manager of the London County Council Tramways, has been appointed by the Home Secretary to be an additional member of the committee which is considering the licensing of partially disabled men as drivers of public motor vehicles.

Mr. J. H. Rider has been retained to advise the combination of Nottingham, Derby, Leicester, Mansfield and other Midland towns on the question of electric power supply. Mr. Rider is taking the place of Sir John Snell, who has accepted a Government appointment.

Mr. C. J. Spencer, general manager of the Metropolitan Electric Tramways and the London United Tramways, has also been appointed general manager of the South Metropolitan Electric Tramways and Lighting Company. **Mr. A. V. Mason** has been appointed engineer to the three companies.

Mr. George Webster, manager of Rochdale Corporation Tramways, has received the Order of the British Empire as a recognition of work done in connection with the war. Mr. Webster for two years acted as honorary secretary of the Rochdale Shell Factory, which carried on work at the tramway sheds in Mellor Street. He was afterwards elected a member of the board of directors.

Mr. Harry Haward, Controller of the London County Council, who has been serving, at the request of the Army Council, on the Committee appointed to inquire into the staff of the War Office, is also serving on a committee appointed by the Chancellor of the Exchequer to consider the recommendations contained in the seventh report of the Select Committee on National Expenditure.

Mr. H. Vernon has been appointed rolling stock and overhead equipment engineer of Belfast Corporation Tramways, in succession to Mr. A. A. Blackburn, who took over the managership of the Huddersfield system on January 1. Mr. Vernon has been superintendent of the tramways engineering works since the electrification of the system 14 years ago. The appointment is subject to confirmation by the Council at its next meeting.

Brigadier-General H. P. Maybury, M.Inst.C.E., formerly chief engineer of the Road Board, will become acting secretary and manager on his return from Egypt, after a brief holiday. For over two years he has had charge of the road battalions working on the British front in France and Flanders. With the advance into the occupied zone in Germany his arduous work was greatly increased owing to the mining of the roads by the retreating enemy.

Mr. H. H. Gregory has been appointed by the Home Secretary to act as Technical Adviser to the Commissioner of Police on public service motor vehicles. Mr. Gregory is the chief of the technical department of the Royal Automobile Club, a member of the Institute of Mechanical Engineers and the Institute of Automobile Engineers. Upon the imposition of the motor vehicle duties two years ago, he was appointed adviser to the Customs and Excise.

Mr. Richard J. Howley, M.Inst.C.E., has resigned his position as joint managing director of the British Electric Traction Company in order to take up private practice. Mr. Howley will continue to act as chairman of the Potteries Electric Traction Company and of the Birmingham and Midland Motor Omnibus Company and in an advisory capacity to the British Electrical Federation. Mr. Howley's present address is the Manchester Hotel, Aldersgate, E.C., where the British Electrical Federation has temporary offices.

Mr. J. F. Cameron, engineer and general manager of Northampton Corporation Tramways, has been unanimously granted an honorarium of £100 by the Town Council, on the recommendation of the Tramways Committee, in recognition of the valuable services he has rendered under exceptionally onerous conditions during the war. Owing to the shortage of staff at the power station and the increasing difficulties during the war, a large amount of extra work has been thrown upon Mr. Cameron. While influenza was rampant he was obliged temporarily to act as stoker.

Inspector Smalley, who has been in the service of the City of Oxford Electric Tramways Company for more than three years, was recently appointed traffic superintendent of the Musselburgh electric tramways. On leaving he was entertained by the Oxford Finches Musical Society at their headquarters at St. Aldgates, and was presented with a suit case subscribed for by the staff of the tramways company. Mr. Campbell, the traffic manager, congratulated Mr. Smalley on his appointment and wished him success in his new position. Councillor Harris spoke in high appreciation of Inspector Smalley's unfailing tact and the ability he had displayed in the difficult times through which they had passed.

Mr. W. Worby Beaumont has resigned the appointment of Technical Adviser to the Chief Commissioner of the Metropolitan Police on public service motor vehicles and tramway cars, but it is understood that his services will continue to be available as a consultant. Mr. Beaumont has for many years been a member of tramway and motor organisations, and he received the Scotland Yard appointment in 1905. At that time the motor omnibus was an unreliable vehicle, but in 1906 it began to be constructed under regulations which effected considerable improvement. A great step in advance was effected as the result of amended regulations issued in 1909. The weight was reduced to 3½ tons and the running became comparitively noiseless, while the use of oil trays prevented the smearing of the roads with lubricants. The only portion of the regulations which has not been enforced is the clause which requires the use of a speed governor. The 1909 regulations will shortly give place to the amended rules issued in April, 1917, to govern new construction after the war. The chief new requirement entails a further reduction of weight.

Mr. A. A. Blackburn, on leaving his position as chief engineer of the Belfast City Tramways to take up the management of the Huddersfield Tramways, was presented with an illuminated address by the members of the staff at Belfast. The general manager (Mr. J. S. D. Moffet), who entertained the subscribers at Ye Olde Castle Restaurant, paid a glowing tribute to the good work done by Mr. Blackburn during the 14 years he occupied the position, first as rolling stock superintendent, and latterly as chief engineer of the Belfast City Tramways, and assured him of the good wishes both of himself and staff for a successful career in his management of the Huddersfield tramways. Mr. Moffet was supported by Mr. H. Vernon (engineering department), Mr. P. Williamson (body shop), Mr. Harrison (overhead department), Mr. T. H. Brennan (stores department), Mr. J. Blemings (chief motor inspector), Mr. S. Carlisle (office staff), Mr. G. Bartley (representing the motormen and conductors), and Messrs. Birch, Hutchinson and Stewart (works department). Mr. Blackburn responded, and thanked those who had worked with him during his term of office for their loyal support and co-operation.

Mr. R. L. Acland, chief electrical engineer to Chesterfield Corporation for the last 18 years and manager of the tramways for nearly as long, has been presented by the staff with a gold watch on leaving Chesterfield to manage a firm engaged in motor transport between London and the West of England. Mr. W. A. Toppin, chief assistant engineer, presided at the gathering. Mr. F. W. Billett who made the presentation, said that while they were glad Mr. Acland was receiving a promotion, they were very sorry to part with him. Mr. Acland had held the scales between the workmen and the Corporation very well indeed. He did not think that in the last 17 years any of those who had served under Mr. Acland could say they had not had fair dealing and justice. On behalf of the staff he wished Mr. and Mrs. Acland success and prosperity, and what was better, health in their new sphere. Mr. Acland, in reply, thanked them for the support they had always given. The position of a manager was not a happy one in this respect—he had to try to

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satisfy the public. One could never do that, but had to do one's best. Then he had to satisfy the committee, and he had always had the benefit of good committees. One thing that had helped towards the success of the undertaking was that the committees put in a manager and they left him to manage, and dealt only with matters of policy. Another section he had to satisfy was the staff, and from the remarks of Mr. Billett, he thought he had been able to carry out that part of the work fairly well. With regard to the future of the undertakings which he had controlled for so long, it was probable that he would remain in touch with the work. Although his new headquarters would be in London, he would be in Chesterfield fairly often. It was probable that Mr. Toppin, chief assistant, would carry on in his place, and he would ask the whole staff to give Mr. Toppin the same loyal support. Miss Robotham, a woman driver, whose plucky action in a car smash a few days previously probably averted a tragedy, was heartily applauded when she rose to present Mrs. Acland with a travelling bag. Mr. R. L. Acland has since been retained as consulting engineer at a salary of £100 per annum.

The death of **Mr. Walter Calvert,** traffic superintendent of Reading Corporation Tramways, occurred during the first week in January. He had been ill for some time. Mr. Calvert was associated with the Norwich Electric Tramway Company for some years, subsequently going to Bournemouth, and thence to Reading.

The Late Mr. Stephen Sellon.—At a meeting of the Executive Council of the Tramways and Light Railways Association, Mr. R. J. Howley, in the unavoidable absence of Sir Arthur Stanley, moved a resolution expressing the sympathy of the Association with the relatives of Mr. Stephen Sellon, who was one of the founders of the Association and a prominent and valued member. Mr. T. B. Goodyer seconded the resolution, which was agreed to by the members silently upstanding. The *Journal of the Tramways and Light Railways Association* for January, alluding to the death of Mr. Sellon, who was one of the vice-presidents of the association, states that the association thus loses one of its earliest and most active members. He was one of the founders of the association in June, 1897, and has ever since taken a prominent part in its work. He was a member of the Council up to October, 1908, when he was elected vice-president and made an honorary member of the Council, whose meetings he regularly attended.

THE RETIREMENT OF MR. W. E. HAMMOND.

Mr. W. E. Hammond, traffic manager of the Metropolitan Electric Tramways, Limited, was on Jan. 23 entertained at dinner in the Holborn Restaurant, London, by his colleagues and others on the occasion of his retirement from office. Mr. A. L. C. Fell, general manager of the London County Council Tramways, presided, and among others present were Messrs. H. E. Blain, J. K. Bruce, James Devonshire, T. B. Goodyer, B. C. Godfrey, J. B. McKinnon, A. N. Mason, A. H. Pott, F. Schofield, C. J. Spencer, H. P. Stokes, and W. C. Ullman.

The Chairman mentioned that Mr. Hammond has been actively associated with tramways since the year 1872, and said that if he was made the subject of a cartoon the appropriate title would be "Fares and Time Tables." Mr. Goodyer, in proposing the toast of the guest of the evening, drew a contrast between tramway conditions as they were in Mr. Hammond's youth and as they are now. Among other things, the minimum fare was twopence, bringing a revenue of from 4s. to 5s. per car-mile. Mr. Devonshire and Mr. Godfrey having supported the toast,

Mr. Hammond made a reply which historically as well as personally was of great interest. He said that he joined the London Tramways Company in 1872. This company, it may be recalled, worked the main tramway routes south of the Thames. In 1882 he transferred to the North Metropolitan Tramways Company, which operated the lines north of the river. With that company he remained till 1904, when he joined the Metropolitan Electric Tramways on the electrification work being nearly completed. His retirement from the position of traffic manager dated from December last. In recalling past times, he said that in the days of horse cars large numbers of American horses were brought into this country. Mules also were introduced; small ones worked three abreast, and large ones were driven in pairs. The first car with cross seats on the upper deck was built at Leytonstone. It was sent to Glasgow Exhibition, and was run in the grounds. Subsequently it was put in service between Moorgate Street and the Manor House, and the old knifeboard style of seat was soon after abolished. The N.M.T. introduced "all-night cars," and a universal fare of 2d. single journey, 3d. return. The L.T.C. also ran omnibuses, a very popular service being that from the Elephant to the Bank. When the London County Council became the owners of the southern tramways, they were stopped from working omnibuses. The universal 2d. fare was introduced on the southern lines in 1878, except on the Greenwich section. This fare was afterwards increased for journeys over the bridges by omnibus, and continued many years until the County Council took over the tramways. The 1d. fare started soon after 1879. In 1882 the penny fare was introduced north of the Thames, and the stages were lengthened from time to time on account of omnibus competition till many stages were over two miles long. Electric cars were first introduced on Barking Road and Romford Road. Parliamentary powers were obtained for electric working, but it was subject to the veto of the local authorities, and nothing was done. In 1891 the N.M.T. acquired the lines of the N.L. Suburban Company, and in 1897 the London County Council acquired the London Street Tramways, together with the 1871 lines of the N.M.T., and leased to the N.M.T. Notice of purchase was given in 1892, but the matter was not settled until October, 1897. In 1892 he was offered the post of traffic manager to the L.T.C., but decided to remain with the North Metropolitan. This company's receipts in 1882 were £290,000; in 1901 the total was £757,000. Although he was told at first that more cars could not be turned at Moorgate Street than was already done, they got up to over 90 cars per hour. The Metropolitan Electric Tramways were formed in November, 1902, by acquiring the Middlesex lines of the North Metropolitan, and electrification was begun. The first portion of the electric system was opened on July 22, 1904, and the last on February 20, 1911. In 1904 the receipts were £82,000, and in 1918, £620,000. The first electrification in London was on May 15, 1903, when King George inaugurated the Tooting line of the County Council.

PRESENTATIONS TO MR. F. W. KETLEY.

The staff and employees of Norwich Electric Tramways Company met in the Council Chamber of the Guildhall for the purpose of making a presentation to Mr. F. W. Ketley, who has resigned the position of manager of the company. The Lord Mayor (Mr. G. M. Chamberlin) a director of the company, presided over a large attendance from all departments. Amongst those present were Mrs. Ketley, Miss Ketley, Mr. F. M. Foster (acting manager), Mr. P. F. Robertson (chief clerk), and Mr. R. C. Spicer (Messrs. Culley and Company). In making the presentation the Lord Mayor said it was a very great pleasure to him to be asked to preside over the meeting of the employees, who wished to do honour to their late chief, Mr. Ketley. He went on to speak of the good feeling which had always existed between every member of the staff and Mr. Ketley, and asked him to accept a solid silver tea service of early Georgian design, bearing the inscription:—"Presented to F. W. Ketley, Esq., manager of the Norwich Electric Tramways Company, 1909–1919, by the staff and employees as a mark of affection and esteem."

Mr. Ketley, in responding, said he felt honoured by the presence of the Lord Mayor, thanked him for his very kind remarks, and incidentally mentioned that the Lord Mayor was the first friend he made in Norwich. He then thanked the staff for the handsome present they had made him. It was especially valuable in his eyes because it was of Norwich workmanship and from old Norwich patterns. A manager invariably got the sort of staff he deserved, and it would appear that he must have deserved a great deal to have such an excellent staff about him as he had had, the members of which he looked upon as the best "pals" he had ever had. Taking each department in turn, he thanked the heads and their staffs for their loyalty to him, and for the hard work that they had put in during his term of office. Mr. Foster moved a vote of thanks to the Lord Mayor for presiding and making the presentation. This was seconded by Mr. Spicer, and the Lord Mayor, after acknowledging the vote, called for cheers for Mr., Mrs., and Miss Ketley.

Especially pleasing to a tramway manager was another presentation which has been made to Mr. Ketley. He was presented by the members of the Norwich City Police Force with a silver cigarette box bearing the inscription, under the city arms, "F. W. Ketley, manager Norwich Tramways, from the Norwich City Police as a mark of esteem and appreciation, 1909–1918." The ceremony took place in the parade room, where there was a strong muster, all sections of the force being represented. The Chief Constable (Mr. Dain) said they had invited Mr. Ketley there to wish him a very happy Christmas and a prosperous New Year, and to say good-bye and God speed to an old and true friend. During the years Mr. Ketley had been manager of the tramway company his relations with the police had been of a most cordial nature, and they would ever hold him in pleasant remembrance. He hoped the cigarette box would in years to come remind Mr. Ketley of the agreeable time he had spent in Norwich and of his friends the city police force.

In responding, Mr. Ketley said the presentation came to him as a very pleasant surprise. He had always been on excellent terms with the police, although before he came to Norwich the relationships between the company and the force were not so good as they might have been, and indeed ought to have been for the sake of the citizens generally. He had no notion what the trouble was, for he had found no better friends anywhere than in the Norwich police, and he was glad to believe that that gift showed that the good feeling between him and them existed up to the end. He had the greatest admiration for the Norwich police and for the way they carried out their work.

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TRAMWAY AND LIGHT RAILWAY NOTES.

AYR.

INCREASED PREMIUM FOR ACCIDENT INSURANCE - TROLLEY WHEEL MILEAGE.

The Law Accident Insurance Society have informed Ayr Corporation that for three years ended Whit-Sunday, 1918, the claims paid amounted to £927, whereas the insurance premium was only £589. They were prepared to renew the policy for another year at an increase of 33⅓ per cent. on the premium, the present rate being 22s. 6d. per cent. The Council decided to renew the policy for a year on the terms proposed, and have agreed to the suggestion of the company that the Corporation should employ a thoroughly qualified independent tramway engineer to make an examination of the whole plant, overhead wires, cars, etc., and to state whether in his opinion the inspection and repairs are efficient. The general manager of Glasgow Corporation Tramways, or, failing him, the general manager of Leeds Corporation Tramways, is to be asked to recommend a suitable engineer to make the inspection and to report thereon. During the last year 182 trolley wheels were used on the Corporation tramways, the average mileage obtained being 4,043, a very good result, as the manager remarks, on a system with so much side running.

BELFAST.

STAFF FOR PERMANENT WAY UPKEEP—SIX-DAY WEEK FOR EMPLOYEES.

The Tramways Committee have received from the general manager (Mr. J. S. D. Moffet) a report upon the staff he would require in connection with the permanent way upkeep, which, under the reorganisation scheme, has been taken over by him. The committee decided to recommend the Council to authorise them to appoint an assistant permanent way engineer to be responsible to the general manager for the general maintenance and upkeep of the track. The Corporation have granted the employees of the tramways department a working week of six days instead of seven.

BIRMINGHAM.

PRAISE FOR WOMEN CONDUCTORS.

According to the *Birmingham Gazette*, the women conductors at Birmingham have with few exceptions "made good." Many of them express regret that it will soon be necessary to give up their employment owing to the return of the men. The average earnings of those working on a seven hour shift are about 30s. a week, while those who work longer shifts and overtime sometimes earn as much as £4 a week.

BLACKPOOL.

THE PURCHASE OF THE TRAMWAYS COMPANY'S UNDERTAKING.

A difficulty has arisen between the Blackpool Corporation and the Fleetwood Council with reference to the purchase of the Blackpool and Fleetwood tramroad. As a considerable part of the undertaking is in the Fleetwood district, the Council consider that they should join in the purchase and become part owners of the tramways. The Blackpool Corporation, however, have refused to agree to the proposal. Fleetwood Council intends therefore to oppose the Bill which the Blackpool Corporation are promoting in Parliament to obtain powers to purchase the undertaking. The purchase price has been fixed by agreement at £235,000, and in addition the Corporation will pay the company £13,758, representing the purchase price of £14,000 six months' Treasury Bills invested by the company out of the profits earned in 1917, but since realised to meet current liabilities. A further £4,000 will be paid by way of compensation to the directors and the general manager and secretary for loss of office, and the Corporation will assume responsibility in connection with the outstanding £35,000 5 per cent. mortgage debentures, redeemable in 1928. Excluded from the purchase are the invested funds of the company, amounting to £42,052, and sufficient cash to pay the declared dividend for the half-year ended December 31, 1917, on the share capital. Blackpool Corporation propose to construct new tramways at a cost of £7,400, a further £1,100 being required for providing electrical equipments and £7,000 for carrying out various street improvements.

BRIGHTON.

GENERAL MANAGER HEADS A QUEUE AT DICK, KERR'S WORKS.

Mr. William Marsh, engineer and manager, Brighton Corporation Tramways, has advised the Council to spend about £6,200 on new car motors. Mr. Marsh states that he had taken the first place in the waiting queue at Messrs. Dick, Kerr and Company's works for sixteen car sets or thirty-two motors, subject to agreement as to price. Messrs. Dick, Kerr and Company have offered forty car motors at £300 per car set. Delivery is expected to begin early in May, and to continue at the rate of eight motors per fortnight. The price for a complete car equipment is £450, as compared with £273 10s. in June, 1914, an increase of 64 per cent. Mr. Marsh advises the acceptance of the offer of the twenty car sets at £300 per car, and also the necessary number of gear cases at about £10 per car extra.

CHESTERFIELD.

PRESENTATION TO A WOMAN CAR DRIVER.

Miss Robotham, a driver on Chesterfield tramways, has been presented with a cheque for £2 by the Tramways Committee and an insurance coupon in recognition of courageous conduct. Alderman Rhodes, in making the presentation, said that Miss Robotham recognising that a collision was unavoidable, knocked on one side the learner, who was driving, and applied the brakes. The car was pulled up before another car dashed into it. The committee, he said, commended her on her conduct, her presence of mind, and her nerve, for she undoubtedly prevented a very serious accident. As a member of the committee, and as a frequent user of the cars, he could say that the girls, as drivers and conductors, had discharged their duties most satisfactorily.

DUNDEE.

WHOLE DAY SERVICE ON SUNDAYS—EMPLOYEES' PASSES WITHDRAWN.

The magistrates have agreed to allow the Dundee, Broughty Ferry and District Tramways Company to run a continuous service on Sunday, cutting out the present stoppage between 11 a.m. and 1 p.m. The company had intimated that if the request were not granted the directors intended to arrange not to begin the service until 1 o'clock in the afternoon. Mr. G. A. Johnston, convener of the Dundee Tramways Committee, has informed the Corporation that the committee had no objection to the change, and they would themselves be making a similar proposal. Mr. Peter Fisher, general manager of the Corporation tramways, remarked that it would be a great advantage to have a continuous service. Dundee Tramways Committee have refused a request of the employees at the central depot for free passes to and from their work. The privilege had recently been withdrawn owing to its misuse.

GLASGOW.

THE NEW PARCEL SERVICE—TRAFFIC DURING THE NEW YEAR HOLIDAYS—SALE OF PAMPHLETS ON THE CARS.

The parcel service which was begun a few weeks ago is at present limited to carriage between two receiving stations. It is thought that the service will be made more popular by a distribution of parcels to consignees at the Uddingston end, and it is possible that arrangements will be made for this. To cope with the extra traffic on the Corporation tramways during the New Year holidays there was a great increase in the number of cars. This is indicated by the car miles run in the first week of January, the total being 576,883, which was 85,146 miles more than in the preceding week, and 8,686 more than in the corresponding week twelve months ago. The passengers numbered 9,089,492, an increase of 535,071 ; while the receipts were £31,100, as against £29,947. At a meeting of the City Council an objection was taken to the practice of selling pamphlets on the Corporation cars. The proceeds of the sales are devoted to war relief funds, but the point was raised that the opinions expressed on some of the topics dealt with did not represent the views of the majority of the people. An assurance was given that when the balance of the pamphlets was disposed of, the sales would cease.

HULL.

OVERHAUL OF TRUCKS, ELECTRICAL FITTINGS, AND OVERHEAD EQUIPMENT.

The tramway electrical engineer has reported to the Hull Corporation Tramway Committee that owing to the severe stress and strain put on rolling stock and overhead equipment during the four years of the war, and the difficulty in obtaining labour and material, he had been unable to keep up the pre-war standard of maintenance, and it will now be necessary to make a thorough overhaul, particularly of the trucks, electrical equipment and fittings, etc., of the overhead equipment. The engineer is re-adjusting demobilised employees with a view to carrying out this work as quickly as possible.

LEEDS.

EXTENSION OF THE PARCEL SERVICE—THE CORPORATION BILL.

The Corporation tramways parcel delivery system has been extended. There is now a through service between Leeds, Bradford, Halifax, and the heavy woollen district. Leeds Corporation Bill has been reported by the Examiner of Private Bills to have failed to comply with the standing orders in respect of the proposed tramways in Middleton, the opponents contending that the construction of the tramways requires the consent of the local highway authorities, which has so far been withheld. The chief purpose of the Bill is the acquisition of 400 acres of land at Middleton for the purpose of a housing scheme, and it is thought that this portion of the Bill is not endangered.

LIVERPOOL.

INCREASED TRAFFIC AND DECREASED CAR MILEAGE—A NEW SHELTER.

At the meeting of the Liverpool Tramways Committee on January 9, Alderman Russell Taylor, referring to the prosperity of the undertaking, said that the increased revenue must not be regarded as profit, as wages had risen greatly and the cost of materials was much higher. Alluding to the great increase in traffic, he expressed

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the hope that the public would give the committee credit for doing the best they could in providing facilities under difficulties. The returns for the year showed that the receipts amounted to £961,022, an increase of £142,955 over those of 1917. The passengers aggregated 195,082,609, an increase of 22,240,115, while there was a decrease in the mileage of 419,814. The Liverpool Tramways Committee have consented to erect a shelter for waiting passengers at the Old Swan terminus.

LONDON.

Campaign for Observance of By-Laws –Boroughs Pressing for New Tramways—Awakening to the Capital's Needs—Motormen in County Court Actions.

It was reported to the London County Council on January 22 that one person had been fined for obstructing the Council's cars, several had been given the option of paying a fine or undergoing a term of imprisonment for assaulting officials, two persons were fined for travelling beyond the distance for which they had taken their tickets, one for refusing to pay his fare, and no fewer than nineteen persons were fined for spitting on tramway cars. Ununiformed officials are employed to detect offenders. At a conference of representatives of Woolwich, Greenwich, and Deptford Councils with members of the Housing Committee of the London County Council, it was suggested that a new tramway route should be made connecting New Cross Gate with Kidbrook and Eltham Road. The chairman of the Highways Committee promised that the tramway from Lee Green to Eltham would be the first care when conditions allowed. It was arranged to hold another conference of the three boroughs shortly to consider improved means of transit for the districts concerned. The *Daily Chronicle* asks for a settlement of the London traffic question as between tramways and omnibuses, and for the absurdity of the numerous dead-ends to be dealt with. Our contemporary adds:—"A good deal is said about the ugliness of tramways, but other cities, municipally better managed than London—Glasgow, Liverpool, and Birmingham, for instance—contrive to bear with them, and the object lessons we have had lately in the inadequacy of our transport must have their effect." Judge Graham, in Bow County Court on January 17, awarded a motorman of the West Ham Corporation Tramways 30s. and costs for wear and tear of his personal clothing, to which he contended that he was entitled owing to the fact that he was not supplied with a uniform from the time he entered the employment of the Corporation in February, 1918, until the following August. At the same Court Judge Graham gave a verdict for West Ham Corporation in an action brought by a motorman who had disobeyed an order to drive a car that in his opinion was defective. The motorman sued for a week's wages and another in lieu of notice, alleging that he could not sound the gong of the car, as the gong pin was too short. For the defence it was shown that the car was taken to a depot a mile and a half away, where an examination showed that there was nothing wrong.

MANCHESTER.

One Hundred Cars Under Construction –A Point in Accident Liability.

The construction of one hundred new cars has been entered upon in the car building shops of the Corporation tramways. In our issue of January 25 the Tramways Committee advertised for car motor and trucks. The deputy Town Clerk has prepared a report for the Tramways Committee dealing with the legal position towards passengers in view of the recent decision of Mr. Justice Bailhache in an action brought against the Corporation by a lady. The judge held that the plaintiff was not entitled to compensation for the accident, because she rose from her seat at the front of the car preparatory to leaving the car when the car was some 70 yards from the stopping-place. The deputy Town Clerk said that the law does not state what precise interval of time shall be allowed between the stopping and starting of a car, and the Tramways Committee would, he thinks, be wise not to try to do what the law has not done. What was reasonable in such matters was a question for judges or juries to determine. In reply, Alderman Bowes, chairman of the Committee, said that they could not say that a certain time should be allowed for passengers to get on or off, because twenty active men might take less time than two or three aged ladies. When they were able to secure the return of the men from the services, the committee would no longer be compelled to employ some persons who were not best fitted for the work.

PLYMOUTH.

Third Party Insurance.

Plymouth Corporation has rejected the Tramway Committee's recommendation that the Corporation should insure against third party risks. The committee were about evenly divided, and there was a sharp difference of opinion in the Council.

READING.

Increased Fares to Meet Cost of Wages Increase.

As a result of the effect which the wages award has had on the financial position of the tramway undertaking, the Corporation propose to raise the fares by 100 per cent. in some cases, and 50 per cent. in others.

RHONDDA.

Through Running to Pontypridd.

The Board of Trade having held that a case has been made out for through running between Pontypridd and Rhondda, an agreement for this purpose has been made between the Rhondda Tramways Company and the Pontypridd Council. The first car was run for experimental purposes on the afternoon of January 2, and proved that the Pontypridd tracks are suitable for the Rhondda cars.

SUNDERLAND.

Forty-seven Hour Week for Depot Labourers.

The Tramways Committee have conceded the 47-hour week to the labourers employed at the Hylton Road depot, but have refused to introduce the two-break system demanded by the skilled artisans.

SHEFFIELD.

Plans for a Tramway Subway.

A draft scheme for a tramway subway in the centre of Sheffield has been considered by the Improvements Committee.

TYNEMOUTH.

Proposed Purchase of the Tramways.

Tynemouth Town Council are promoting a Bill providing for the acquisition and extension of the undertaking of the Tynemouth and District Tramways Company.

YORK.

Penny Stage Retained.

York Council have decided to retain the penny stage. Councillor Horsman, in making the proposal, said that while the receipts showed an increase of £200 per week, less passengers were carried. Alderman Inglis, who seconded, said that while many people would not bother about spending a penny, they would consider a fare of three-halfpence a waste of money. It was easy to devise a scheme under which the penny fare could be retained.

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ENGINE PACKING
MANUFACTURERS
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And all Engine Room Stores
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PATENT LIST.

Abstracted for "The Tramway and Railway World" from the Official Journal of Patents.

***** If the inventions have been communicated the names of the communicators are given in italics.**

Applications for Letters Patent.

The number of the patent is given in brackets.

Motor car bodies (171)—G. Bowman.
Wheels for motor vehicles (264)—F. W. Brampton.
Tin feeler gauge for motor cars (269)—J. Bray.
Wheel rims and wheels for motor vehicles (292)—J Cooper and Grimston Tyres Limited.
Driving gear for motor vehicles (206)—J. J. Daniels.
Automatic lifeguard for motor vehicles (181)—W. C. Hockey.
Driving and speed controlling mechanism for automobiles (64)—F. W. Howorth (*M. J. Huggins*).
Wheels and tires for motor cars (29)—J. Jack.
Switch operating mechanism for railroads (220)—B. E. D. Kilburn (*Bethlehem Steel Company*).
Apparatus for lighting motor wagons, etc., with varying steam power (33)—C. L. Kirk.
Radiators for water-cooled engines used on motor-propelled vehicles (198)—C. McManus.
Means for adjusting position of gear boxes on motor vehicles (102)—E. C. Middleton and Triumph Cycle Company.
Automobile vehicles (236)—U. Pavesi.
Bodies and body parts for motor vehicles (42)—Regent Carriage Company and M. L. Scarff.
Motor car bodies (171)—R. C. Robb.
Change speed gearing (239)—M. Rose.
Means of fixing rails to concrete sleepers (207)—D. H. Stent.
Reinforced concrete sleeper for railways, etc. (208)—D. H. Stent.
Clutches for motor vehicles (297)—W. N. Baker.
Variable speed gear (727)—A. R. Bannister and J. L. Bisset.
Motor vehicles (661)—H. Weld-Blundell.
Bodies of motor, etc., vehicles (568)—F. M. Charles.
Automobile vehicles (766)—M. A. Delque (Habans).
Railway train systems, etc. (534)—W. Aitken.
Variable speed gears (649)—R. Lindsay.
Brake gear (574)—C. Markham.
Creep anchors for rails (482)—F. R. Morgan.
Automobile vehicles (766)—C. M. Motte.
Gears for vehicles (502)—C. F. Ryland.
Motor bodies (634)—W. H. Sadgrove.
Wheels for motor vehicles (548)—J. D. Siddeley.
Devices or apparatus for measuring speed of vehicles (648)—J. B. Tucker.
Means for lifting vehicle wheels or axles (348)—W. Watson.
Construction and control of change speed gears (458)—J. Yoxall.
Automobile air brakes (908)—C. T. Alexander.
Electrically-driven vehicles (1,009)—A. R. Angus.
Lifting jacks (1,186)—J. Baron (*S. Baron*).
Temporary axles for motor vehicles (1,045)—J. B. Brown and P. Lister.
Speed indicator (991)—B. C. Bucknall.
Track appliance for automatic train stops (895)—M. B. Bulla.
Variable speed and clutch mechanism (1,152)—S. F. Burgoine and H. F. Field.
Means for indicating route and speed of motor vehicles (1,332)—F. H. Cave, G. G. C. Pigott, and C. J. Stewart.
Fluid pressure braking apparatus (1,169)—J. W. Cloud.
Signals for automobiles (905)—S. Cohn.
Automobiles (887)—O. A. Janemian.
Trolley wheel mechanism of overhead electric tramway systems (1,044)—W. R. Jenkinson.
Device for facilitating steering and controlling of motor, etc., vehicles (1,022)—W. E. John.
Station or stopping place indicators for vehicles (1,023)—B. E. Nordman and P. H. Waller.
Converting motor car into motor lorry (1,170)—F. Osbourn.
Fluid pressure braking apparatus (873)—A. W. Rendell.
Heat treatment of railway and tramway rails (885)—C. P. Sandberg and H. Scholey.
Device for reducing or multiplying speed (1,274)—E. J. A. Schultz.
Variable speed gearing (880)—S. Sheen and W. W. Timewell.
Springing of road and rail vehicles (1,164)—J. G. P. Thomas.
Means for locking motor vehicles, etc. (1,269)—A. G. Turner.
Means for stopping trains and detecting signal over-running (1,021)—J. S. Withers (*B. N. Rao*).
Hub cap and pump for automatic lubrication of chambered wheels of tramway, etc., vehicles (1,611)—T. Abbott.
Transmission gearing for motor vehicles, etc. (1,804)—Arrol-Johnston, Ltd., and G. W. A. Brown.
Automatic brakes for trailers, etc. (1,695)—S. G. Ashly and V. Barningham.
Resilient wheels for motors (1,624)—W. H. Bailey.
Motor tires, etc. (1,758)—E. S. Brown.
Door controllers for railway, etc., vehicles (1,494)—C. C. Champeney and F. W. Marillier.
Vehicle wheels for automobiles (1,435)—J. H. Delattre.
Automobiles (1,853 and 1,855)—G. N., Limited, and H. R. Godfrey.
Road wheels of automobiles, etc. (1,383)—E. F. Goodyear.
Preventing wheels of motor vehicles splashing mud etc. (1,396)—C. Guise and T. J. Southall.
Vehicle bonnets (1,438)—G. H. Lanchester and Lanchester Motor Company.
Change speed mechanism (1,443)—A. B. Landis.
Device for pulling off wheels of motor vehicles and preventing water entering wheel covered by a disk (1,681)—N. D. Levin.
Automatic couplings (1,816)—A. Main and H. Woodgate.
Overhead or elevated rail tramways, etc. (1,519)—S. A. Rogers.
Shelter for passengers on road vehicles (1,386)—W. Stone.
Anchorages for railway tracks, etc. (1,645)—O. Valeri.
Chairs for rail joints (1,371)—F. S. Wigley.

Specifications Published.

1917.

Variable speed device (18,075—*121,184*)—S. Bobrovsky.
Means for supplying fuel, water or oil in connection with the engines of motor cars (9,750—*121,300*)—F. Sage and Company and E. C. G. England.
Brake blocks and linings and clutch linings (12,881—*121,301*)—H. Frood.
Train and like control systems (18,221—*121,327*)—A. Kerr.
Combined internal combustion engines and driving wheels for motor vehicles (18,717—*121,360*)—F. B. Silk.
Gas storage apparatus for motor road vehicles (18,765—*121,514*)—W. H. Bentley.
Change speed gearing (15,544—*121,616*)—Wolseley Motors, Limited, and E. Reeve.

1918.

Automatic indicating apparatus displaying vehicle stopping places (64—*112,620*)—E. Riffard.
Gas producers for propelling vehicles (15,900—*121,446*)—D. J. Smith.
Rail joints (7,227—*121,564*)—G. Hughes (*J. M. Phinous and G. E. Shorter*).
Excess speed alarm for tramway cars (38—*121,645*)—H. S. Dix, J. T. Pryor, and C. Coffey.
Means for raising tramway cars from the rails (241—*121,646*)—J. Hoggett.
Lifting jacks (2,841—*121,671*)—R. W. Maudslay and Standard Motor Company.
Spraying apparatus for use upon automobiles for laying the dust raised on the roads traversed (10,842—*121,699*)—J. A. Vanrossum and H. A. Bull.

TENDERS INVITED.

CITY OF BIRMINGHAM TRAMWAYS DEPARTMENT.

Electric Tramway Cars.

The Tramways Committee are prepared to receive Tenders for the Supply, Delivery, and Erection of Additional Rolling Stock.

A form of tender, with instructions, general conditions, specification, and drawings can be obtained on application to the undersigned at the Tramway Offices, the Council House, Congreve Street, Birmingham, on payment of £2, which will, after the Committee shall have come to a decision upon the tenders received, but not before, be returned to the tenderer, provided he shall have sent in a bona-fide tender.

Persons tendering must at the time of tendering and at all times during the execution of the work be paying all their workpeople (except such as may be employed under special provisions agreed upon by the employers and the local organised bodies of workers) not less than the Trade Union or Standard Rate of Wages in the several districts where the workpeople are actually engaged in the execution of the works, and must also be observing the hours and conditions of labour, as well as the aforesaid rate of wages, recognised by the Associations of Employers and the Local Organised Bodies of Workers in the various trades in the several districts where the works are being done. The tender of any Contractor who does not pay the Trade Union or Standard Rate of Wages or observe similar conditions in his ordinary business will not be accepted.

Tenders must be enclosed in a sealed cover, addressed to the Chairman of the Tramways Committee, the Council House, Congreve Street, Birmingham, and endorsed in the left-hand corner "Tender for Rolling Stock," and must be handed in not later than 10 o'clock on Wednesday, the 5th March, 1919.

The Tramways Committee do not bind themselves to accept the lowest or any tender.

ALFRED BAKER,
General Manager.

Tramway Offices,
The Council House,
Congreve Street, Birmingham.

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TRAFFIC RETURNS.

Tramway and Omnibus Undertakings in the United Kingdom.

NAME OF COMPANY OR CORPORATION.	1918. WEEKS ENDED.					1919. WEEKS ENDED.					AGGREGATE.		
	Jan. 5	Jan. 12	Jan. 19	Jan. 26		Jan. 4	Jan. 11	Jan. 18	Jan. 25		Wks.	1919.	Increase or Decrease.
	£	£	£	£	£	£	£	£	£	£		£	£
Aberdare U.D. Council	507	440	430	452	...	615	536	526	538	...	41	21.511	—
Aberdeen Corporation	2.496	2.182	2.020	2,050	...	2.775	2.870	2.552	2.495	...	34	88.831	+ 13.380
Ayr Corporation	430	321	291	319	...	507	424	431	395	...	36	22.262	+ 4,708
Belfast City	...	...	...	...	...	...	...	...	...	...	—	—	—
Birkenhead Corporation	1.811	1.766	1,811	1,934	...	2,137	2,214	2.139	2.088	...	43	94.325	+ 14.882
Blackburn Corporation	1,687	1.224	1.244	1,378	...	1,212	1,086	1.181	1.538	...	43⅞	76.504	+ 12 437
Bradford Corporation	7,812	7.086	6.588	7,472	...	8.710	9.346	9.677	9.051	...	43	398.856	+ 69,093
Burnley Corporation	1.995	1.790	1.718	2.060	...	2,268	2,493	2.661	2 501	...	—	—	—
Burton-on-Trent Corporation	345	344	372	370	...	441	435	425	412	...	43	17 823	+ 4.061
Bury Corporation	1,698	1.357	1.415	1.597	...	2.119	2.020	1.970	1.928	...	43	87.994	+ 17.238
Chatham and District	578	1 473	1.057	1.176	...	899	1.520	1,183	1.228	...	3	3.930	+ 224
Cork Electric	300	726	531	577	...	427	679	554	563	...	3	1.796	— 38
Derby Corporation	1.276	1.114	1.129	1.245	...	1.487	1 434	1,458	1.445	...	43	64,562	+ 12.196
Dundee City	1.820	1.595	1 413	1.486	...	2.167	2.179	2 011	2 042	...	36	70 438	+ 14.280
East Ham Corporation	1.197	1.194	1.215	1.267	...	1.689	1 586	1.567	1.500	...	42⅜	67 361	+ 8 589
Glasgow Corporation	29 947	24.874	21.965	24.081	...	31.100	28.912	29.002	27.752	...	34¼	980.683	+ 79,979
Glossop (Urban Elec. Supply Co.)	184	170	157	177	...	182	210	210	211	...	4	812	+ 124
Halifax Corporation	2.570	2 092	1,851	2.025	...	2.931	2.347	2.777	2.775	...	42¼	120.190	+ 16 202
Halifax Corp. Motor Omnibuses	58	48	40	47	...	76	54	69	72	...	42¼	2.845	+ 768
Huddersfield Corporation	3.094	2.893	2.856	3.238	...	2.621	3.675	3.739	3.608	...	43	156,212	+ 20.443
Ilford U.D. Council	...	...	...	...	...	...	...	...	...	...	—	—	—
Ipswich Corporation	558	555	535	583	...	715	643	671	654	...	43	32.294	+ 3.587
Isle of Thanet	164	164	178	197	...	371	304	318	282	...	16⅜	5.241	+ 2,412
Kilmarnock Corporation	315	203	198	219	...	403	293	279	281	...	36⅜	9.743	+ 2.252
Lanarkshire	2.009	4.986	2.450	2.399	...	2.962	5.888	3.587	3.509	...	3	12.984	+ 3,149
Lancashire United	...	...	...	...	...	...	...	...	...	...	—	—	—
Leeds City	10.866	10.209	10.324	11.057	...	13.397	13.917	13.744	13.454	...	43	581.497	+108.966
Leicester Corporation	3.985	3.965	4.256	4.227	...	4.970	4 832	4,889	4 838	...	—	—	—
Leyton U.D. Council	1.721	1.639	1.671	1.667	...	2.629	2.539	2.459	2.437	...	43	102.079	+ 21.417
Liverpool Corporation	16.291	15.717	15,637	16.454	...	20.060	20.272	19.882	19.221	...	3¼	71,324	+ 13 491
Llandudno and Colwyn Bay	243	196	202	214	...	346	292	304	290	...	8	2.381	+ 597
London County Council	52 474	50.471	52.610	53.548	...	69,720	71.013	69,410	69,004	...	42¼	2.817,027	+473.427
Maidstone Corporation	288	242	231	248	...	363	312	276	278	...	42¼	12.227	+ 1 673
Manchester Corporation	22.445	21.663	21.722	23.382	...	25.515	26 399	27.089	26.996	...	43	1,121,032	+220.282
Newcastle-on-Tyne Corporation	8.149	7.444	7,472	8.319	...	8.133	8.720	8,385	7,969	...	43	384,905	+ 47.657
New St. Helens and District	...	...	...	...	...	...	...	...	...	...	—	—	—
Northampton Corporation	861	812	757	879	...	1.069	960	987	967	...	42	37.937	+ 1.731
Nottingham Corporation	4,602	4,489	4.526	5.061	...	5,961	5.848	5.978	5.966	...	43	246.523	+ 54,509
Oldham Corporation	...	...	...	...	...	...	3.510	3.573	3.441	...	—	—	—
Reading Corporation	1.049	1.043	1,025	1.140	...	1.248	1 218	1.310	1.327	...	42¼	55.576	—
Rhondda Tramways	1.587	1.391	1.411	1.472	...	2.191	2.102	2.099	2.113	...	3	6.899	+ 2.178
Rotherham Corporation	1.854	1.794	1.872	2.055	...	1.858	1.984	2.036	2.074	...	43⅜	100,187	+ 20 772
Sheffield Corporation	12.314	11.946	12.081	13.167	...	11.669	12.885	12.939	12.766	...	43⅝	581.924	+ 50.879
Southampton Corporation	2.113	2 043	2.089	2.239	...	2.385	2,389	2 379	2 339	...	42⅜	108.036	+ 19 801
Southend-on-Sea Corporation	619	534	629	657	...	1 296	1.095	1,103	1,109	...	43	56.903	+ 18.776
South Shields Corporation	1.072	962	953	1.023	...	1,154	1,135	1.105	1,128	...	43	49,490	+ 8.330
Sunderland Corporation	2 056	1.770	1,875	2.113	...	2.559	2.404	2,431	2.332	...	43	94.040	+ 14.196
Swindon Corporation	283	262	269	285	...	352	309	308	314	...	42⅜	13.498	+ 1.880
Torquay Tramways	673	620	611	629	...	895	735	739	743	...	3	2.458	+ 404
Tyneside Tramways and Tramroads	892	719	705	...	...	922	860	840	...	...	3	1.831	+ 136
Wallasey Corporation	1,476	1.368	1.350	1.445	...	2.005	1.961	1.932	1.848	...	42⅜	80 769	+ 13.100
Walsall Corporation	1.027	983	1.016	1.076	...	1.312	1.257	1.284	1.265	...	43	53.437	+ 10 506
Walthamstow U.D. Council	1.079	1,043	1.110	1.189	...	1,467	1.379	1.358	1.307	...	43	62.136	+ 9.718
Warrington Corporation	...	...	...	...	...	...	...	...	...	...	—	—	—
West Ham Corporation	3.412	3.300	3,472	3,769	...	4.892	4.721	4.693	4.561	...	42¼	195.823	+ 39.308
Wigan Corporation	...	...	...	...	...	...	...	...	...	...	—	—	—

*** A number of undertakings have suspended the issue of traffic returns for the duration of the war.

Colonial and Foreign Tramway Traffic Returns.

NAME OF COMPANY.	1918. WEEKS ENDED.					1919. WEEKS ENDED.					AGGREGATE.		
	Jan. 5	Jan. 12	Jan. 19	Jan. 26		Jan. 4	Jan. 11	Jan. 18	Jan. 25		Wks.	1919.	Increase or Decrease.
	£	£	£	£	£	£	£	£	£	£		£	£
Anglo-Argentine	53.008	54.406	52,850	49,151	....	60,067	24.160	54 003	54.769	...	4	192.999	+ 16,416
Calcutta Rs.	76.589	74,044	75.379	71,406	....	87,061	88.190	88.807	82.787	...	3¼	314.541	+ 48.677
Madras Rs.	....	....	....	....	....	....	....	....	....	...	—	—	—
Pernambuco	5,467	4,651	4.881	4.495	....	5,734	5.117	5.275	5.146	...	3⅜	19,625	+ 879

Companies Issuing Monthly Statements only.

	1917.					1918.	1918.					1919.	Wks.	AGGREGATE.	
	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Aug.	Sept.	Oct.	Nov	Dec.	Jan.		1918.	+ or −.
	£	£	£	£	£	£	£	£	£	£	£	£		£	£
Ballarat & Bendigo	2.766	3,072	3.546	3.405	...	...	2,996	3.430	3.690	3.570	...	...	32	27.090	+ 1,512
Brazilian Trac. Mlrs	8064000	7925000	8006000	7.695000	...	...	9491000	9081000	8052000	7581.000	...	...	47	93.363,000	+9.232,000
Brisbane	36,925	31,600	33,580	32.901	35,019	...	42.670	35,400	36.780	39,246	38.135	...	52	440.014	+ 43,675
British Columbia	$454,425	457,709	491.964	525.629	...	...	544,339	575,476	580,354	612.893	...	...	21	2,727,030	+ 358.925
Buenos Ayres L'c'z.	39,111	33,655	39,067	39,678	40.901	...	41,817	41,006	41,843	42.952	50.460	...	26	259,224	+ 28,748
Burma	26,714	26,167	28.955	27,760	26,224	...	41,855	30,836	34,848	34,407	34,593	...	21	176,539	+ 40,719
Cape Town	15,480	...	17.128	16.522	...	...	19,055	17,872	13,877	18.385	...	...	—	—	—
Carthagena & H.	4,164	4,306	2,805	3,932	4,424	4,011	2,729	2,549	2,525	2,988	2,950	3.655	4	3.655	— 356
Cordoba	14,233	...	...	...	...	...	15,734	...	...	...	...	...	21	79,054	+ 8,740
East India	1,562	1,512	1,229	871	1,099	...	1,975	1.939	2,044	1,947	2,048	...	21	9,953	+ 3,680
Kalgoorlie	2,911	3.063	...	...	...	...	3.340	2.947	...	...	...	...	39	25.070	+ 942
La Plata	4,075	3,450	4.069	3.742	4.606	4.711	4,382	4,999	5.177	5.334	5,792	5.730	4	5.730	+ 1,019
Lima	38,424	35,636	37,612	37,249	...	...	44,711	42,861	45,336	44,948	...	...	48	479.952	+ 82 898
Manaos Rs.	150,657	...	...	...	...	...	132,507	...	...	...	...	...	34	1.152.686	— 83,959
Manila	$149,150	152,200	157,400	159,000	...	...	200,000	204 500	214,898	214,292	...	...	48	2,090,630	+ 466.897
Monte Video	28.860	29,426	30.153	...	34.025	...	16,937	29,611	33,203	...	38,441	...	8	70.139	+ 5 054
Peruvian	$979,430	950,740	1047220	899.680	1101090	1189350	1029610	957,910	1090815	897.090	1057990	1009650	30	7,030,365	— 247.255
Port Elizabeth	3,360	...	3,885	3.807	...	...	3,725	3,661	2,751	3 498	...	...	—	—	—
Rangoon	4,788	5,163	5,667	5,358	5,438	...	5,760	6,067	6,566	6,611	6,188	...	52	71,992	+ 11,174
Toronto	$1039819	1023517	1043886	1052000	...	...	1070567	1119925	1048478	1071106	...	...	47	11.716,181	+ 729,183
Winnipeg	$248,457	267,170	301,772	305.881	...	...	288,974	285,670	295,005	283,721	...	...	47	3,252,863	+ 213,466

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The Daimler Two-Tonner sets the standard for Commercial Motor Vehicles

"AS good as a Daimler" is a well-known phrase of recommendation.

The reliability of Daimler Commercial Vehicles is an axiom in motor transport circles, and their cost of maintenance is the lowest known.

The Daimler is not the only serviceable lorry on the road, but however good other vehicles may be they must all fall short of Daimlers in relation to engine performance and continuity of service.

The Daimler standard of efficiency is only within the scope of the Daimler Sleeve-Valve Engine.

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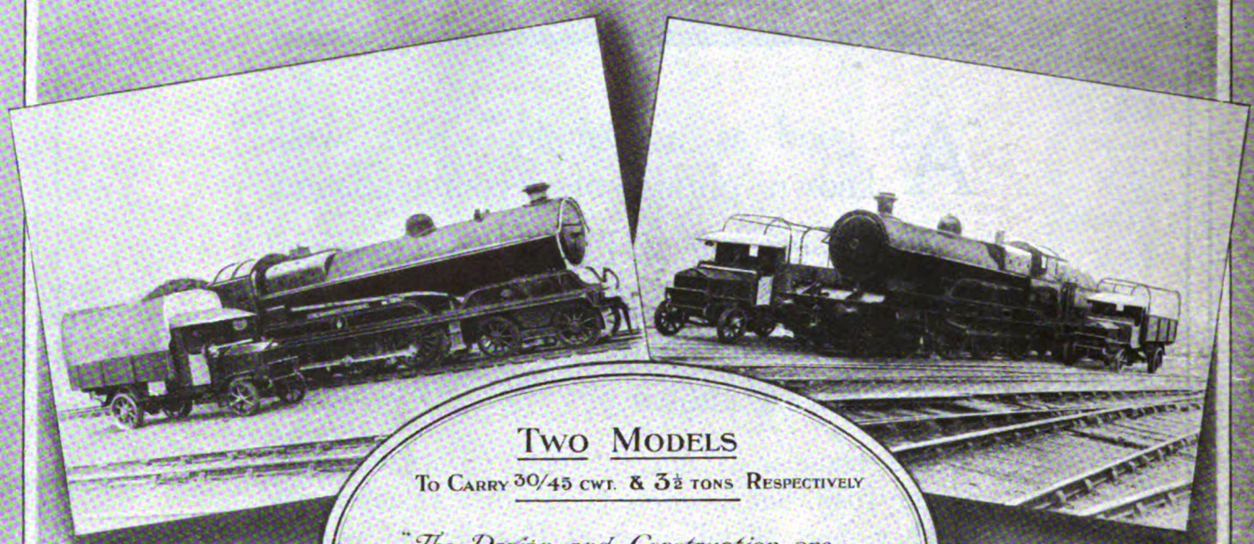
MOTOR VEHICLES.



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TO CARRY 30/45 CWT. & 3½ TONS RESPECTIVELY

"The Design and Construction are Throughout of a Character, which it would be Exceedingly Difficult, if not Impossible, to Improve Upon."

RAILWAY GAZETTE, MARCH 31, 1916.

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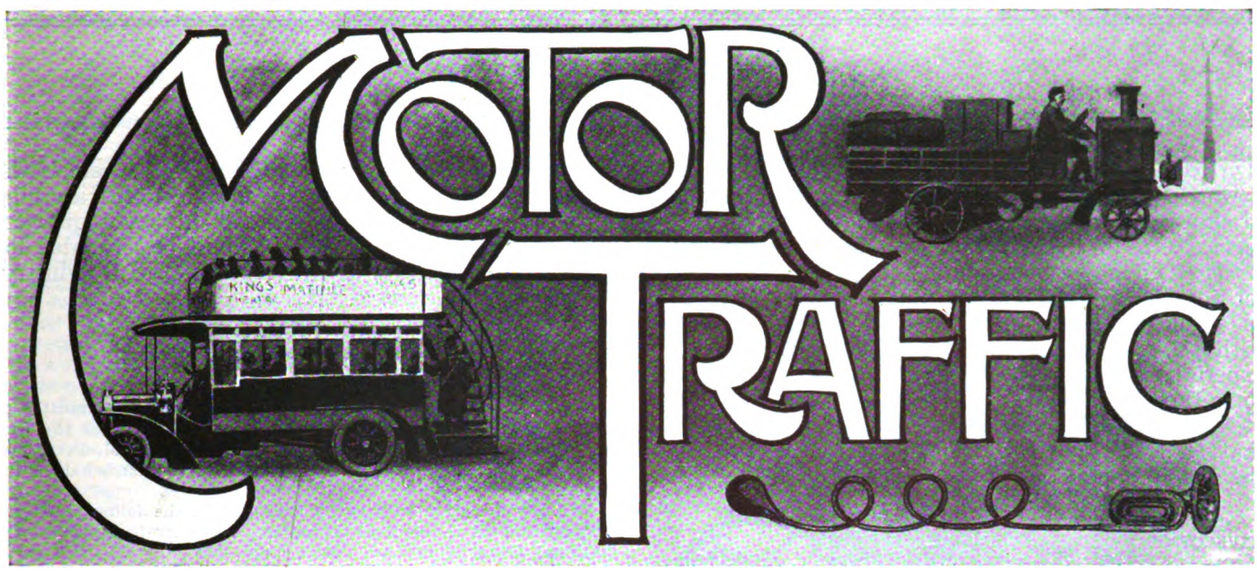

NATIONAL CONTROL OF TRANSPORT.

The Ministry of Ways and Communications, previously referred to as the Ministry of Transport, has become almost, if not quite, an accomplished fact. Sir E. Geddes' new charge should become a great power for good or evil, but that it possesses potentialities for evil is clearly enough illustrated in the resolution which has been passed by the National Council of the Commercial Motor Users' Association. This Council "having considered the proposal to place the control of (*a*) roads and road transport, and (*b*) railways under the same Ministry, is of opinion, the interests concerned being seldom identical and sometimes conflicting, that housing and other national reconstruction programmes, and developments of industrial and agricultural road transportation, are likely to be retarded unless such control be entrusted to distinct and separate Ministries or guarantees of like effectiveness be provided by the Government in any new departmental organisation." This resolution might have been expressed in simpler language, but anyone who reads it carefully will see that it is good at heart if unattractive in form. The danger indicated is a very real one. There are plenty of people who seem to think that the terms "transport" and "railway" are practically synonymous; that a Ministry of Ways and Communications might equally well be called a Ministry of Communications by Railways; that anything in the nature of road traffic is merely a subsidiary which can be classified as an unimportant appendage of the railway system. The new Ministry is to start with a railwayman at its head, but it is to be hoped that railway influence will not permeate the whole structure. If it does there is a serious risk that it may be used as a means of protecting railways against the justifiable and stimulating competition of younger and in some ways more progressive systems of transport. If the railways in their early days were capable of practically killing the canal system without official support, how great must be the danger of the railways, thoroughly officialised, taking up such a predominant position as would hamper very seriously the development of any new competitive method.

RAILWAYS AS USERS OF MOTOR TRACTION.

The railways are themselves considerable potential users of motor traction, and this will complicate the problem of nationalisation. From this fact it seems to follow that if railways are nationalised a percentage of road motor vehicles becomes nationalised also. It is then in the power of the central authority to kill independent competition on the roads by running services at a loss at the expense of the taxpayer. Any protest would be met by the argument that the loss is only apparent; that it is really a gain, inasmuch as road motors increase the traffic of the railways, so the taxpayer has no ground for complaint. There is a good substratum of truth often to be found in this contention, but the danger is that it may be used as a means of employing the taxpayer's money for the purpose of destroying the taxpayer's individual enterprise. A very useful statement made by Mr. Frank Potter before the Select Committee on Transport shows the uses to which the railways put road motors. Thus the Great Western uses road vehicles fairly extensively to develop districts where geographical difficulties make railway extensions improbable or impossible; also as feelers to ascertain whether local traffic can be brought up to the point at which a light railway is justified, and for seasonable services to places of holiday and tourist interest. On some passenger services the road vehicles are constructed to carry luggage, parcels, light goods, and mails. In addition to passenger services, a large number of vehicles are employed for parcels cartage at various big centres; a considerable number are also used for goods cartage. For the former work the majority of the vans are 1-ton vehicles, but the tendency is to employ 30-cwt. vehicles. The representatives of this class in 1915 showed an average cost per mile of just under 4½d., which is certainly very satisfactory. So also was the record for the 3-ton vans during the same year, being just over 6d. In goods cartage the work is heavier and the conditions worse. The majority of the fleet consists of 3-ton, though 5-ton and 30-cwt. lorries are also represented. The average operating cost of the 3-ton machines in 1915 was 7¼d.; of the 30-cwt. vehicle 5½d., and of the 5-ton just under a shilling per mile.

* * * * * *

The efforts that the Great Western and other railways have made in the way of developing rural services for the collection and delivery of farm produce have not met with very much encouragement. It appears that just at first the novelty of the idea brings a certain amount of traffic to a service of this kind, but that after a little interval the traffic falls off, particularly if rather a slack time is reached and the farmers are able to get a fair amount of their work done by their

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MOTOR TRAFFIC

own teams. Apparently the farmers do not consider it worth while to co-operate or to go out of their way to support a motor service, and consequently such a service can only be run at a loss. The conclusion is that there is not much of an outlook in this direction for the use of road motors, unless the State sees fit to subsidise their employment. It would, however, perhaps be unfair to jump to this conclusion. The experiments made by the railways were conducted some time ago. During the last few years the outlook of the farmers has changed materially, and it may be that, if identical experiments were again renewed, the results would be very different from those recorded.

DEVELOPMENT OF NEW INDUSTRIES.

The report of the Engineering Trades (New Industries) Committee has now been published, and will be found very interesting to engineering firms generally, inasmuch as it makes a number of valuable suggestions as to the development of numerous branches of the industry new to this country. The reports of the various Branch Committees are embodied with that of the main committee. The principal work of the Motor Industry Branch Committee consisted in obtaining materials and other facilities to enable motor manufacturers to produce and test experimental models of their post-war products. In dealing with the special circumstances surrounding the industry at the conclusion of the war, it is pointed out that one of the great difficulties lying ahead is that of stabilising the market in face of the big influx of second-hand vehicles. The solution of this problem is now in the hands of the Ministry of Supply. The scheme put forward by the industry, as we have already stated, would provide that the vehicles should be repaired by their original manufacturers and then sold by the manufacturers, acting for the Government. The regular sales organisation of the industry would thus be employed, and the interests of purchasers would be safeguarded, inasmuch as the condition of the vehicles would be guaranteed. We note with interest that the Engineering Trades Committee appears to endorse the view of the Branch Committee to the effect that the motor industry needs protection by means of a substantial tariff for a period of years after complete prohibition of import is removed. Incidentally, it does not look as if the prohibition is likely to come off just at present.

FUTURE OF MOTOR EXHIBITIONS.

There is much talk as to the future of motor exhibitions. While a certain number of those immediately concerned would like to see the old system perpetuated, there are many who feel that the changed circumstances demand that British manufacturers should exercise more control in the organisation and arrangement of their own shows. This does not necessarily mean that the foreigner would be excluded, but more probably that he would come in as a guest rather than as a matter of right. There remains, of course, the question of whether, under these circumstances, the foreign vehicle would be accommodated after space had been provided for all British firms desirous of exhibiting. It is a great pity that there is not a suitable building really big enough for the purpose. For years past would-be exhibitors have been crowded out, and in the future this is likely to occur even more frequently and extensively. Then again, there is the question of what is to happen to the profits accruing from a show. A feeling prevails in some quarters that at least a part of them should be available for expenditure purely in the interests of British industry. This is not the case at present.

C.M.U.A. AND RECONSTRUCTION.

Mr. E. S. Shrapnell-Smith, the chairman of the committee of the Commercial Motor Users' Association, who has for the past year discharged the duties of executive officer of H.M. Petroleum Executive, has issued the following circular letter on behalf of the Association :—

It is my intention to urge the adoption of the following at the first meeting of the general committee (hereafter to be styled the National Council) in the New Year;—

1. Abandonment at the earliest date of petrol licensing and other control measures due to the war.
2. Continuation of pressure to secure lower prices for motor spirit and other fuels.
3. Steps to ensure specifications for petrol and benzol which will guarantee good and uniform quality.
4. Development of all home fuels and their use free of excise duty.
5. Simplification of procedure under which commercial motor users are entitled to recover the petrol tax rebate (now 3d. per gallon).
6. Proceeds of motor spirit tax and vehicle licence duties to be paid into a central road fund and applied to road improvements.
7. Better roads and bridges.
8. Opposition of all unjustifiable bridge and highway restrictions.
9. Speeding-up of terminal services for commercial motors at docks, wharves, warehouses, and goods yards.
10. All road users to be required to conform to adequate lighting regulations.
11. No local tolls.
12. Creation of inexpensive and speedy appeal procedure in cases where authority or discretion concerning licences or routes is in the hands of local councils.
13. Active propaganda work amongst members of Parliament.
14. The simplification and codification of highway, traffic, and motor vehicle law.
15. Permanent strengthening of the Association's central defence fund.
16. Divisional and area organisations for members with local self-government.
17. Extension of Association's provision for independent expert engineering advice, examination, and report.
18. Extension of the Association's scheme of approved depots and roadside supply facilities.
19. Extension of the Association's free legal advice and defence.
20. Extension to the provinces of the Association's examinations for drivers.

LONDON REGISTRATION OF MOTOR CARS.

The Public Control Committee of the London County Council have submitted the following particulars of registrations effected and licences issued under the Motor Car Acts during the three quarters ended September 30, 1918 :—

Quarter ended	Mar. 31, 1918.	June 30, 1918.	Sept. 30, 1918.	Total to Sept. 30, 1918.
Motor cars registered	829	1,190	1,073	109,584
Heavy motor cars registered	200	317	202	11,855
Motor cycles registered	384	693	575	54,469
Changes of ownership—motor cars ...	1,275	1,121	1,182	48,663
Changes of ownership—motor cycles ...	307	295	297	27,191
General identification marks issued ...	99	72	69	—
Copies of entries in register furnished	107	110	140	—
Licences to drive issued	9,431	12,031	11,591	593,805
Duplicate licences granted	131	147	170	—

BATTERY TRACTION FOR TRAMWAY UNDERTAKINGS.—A 2-ton road chassis has been delivered for the Christchurch Tramway Board (N.Z.), and fitted with a 20-passenger body for service on the Sockburn-Hornby route. Two batteries are being used on this omnibus, so that one can be charged while the other is in use.

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THORNYCROFT DEVELOPMENTS AT BASINGSTOKE.

At the invitation of the directors of Messrs. J. I. Thornycroft, Limited, a party of newspaper representatives recently inspected the company's motor works at Basingstoke. The visitors witnessed the various processes of manufacture of the latest types of vehicles which have earned such a high reputation in every department of national service. Messrs. Thornycroft were amongst the pioneers of industrial motor vehicles, and since 1899 have supplied machines of various types to the several Government departments, as well as to railway companies, municipal authorities, and general industrial undertakings.

During the war practically the whole of the firm's output of road motors was taken by the War Department, and although the complete range of Thornycroft models include a 30-cwt chassis and one designed for a net load of five tons, for the past four years the whole of the motor department's resources have been concentrated upon the production of two models only. These are listed respectively as "J" and "X" types, the former being the well-known War Office model, of which some thousands were supplied for use with the Allied armies. The "X" type is shown in Fig. 1, and is the machine which was selected by the Indian Government and standardised for service with the Indian Army in Mesopotamia, Palestine, etc.

Fig. 1.—X Type Thornycroft Lorry as Used by the Indian Government.

The "J" type, an illustration of which appeared in our issue of December 16, was designed to carry a net load of 4 tons, and has obtained the highest commendation from military users for its durability, efficiency, and freedom from breakdowns. For standard lorry or van work this chassis has a wheel base of 13 ft. 7½ in., but for omnibus and chars-a-banc services, for which this type is eminently suited, a special long wheel base of 14 ft. 4½ in. is arranged for.

Designed for loads not exceeding three tons, the "X" type is of lighter construction. The latest of the heavier models is known as the "Q" type, and while the general characteristics of the design are similar to those in the "J" class, the frame and transmission are of stronger make, in order to deal with the heavier loads for which this model is intended.

Each of the three models is fitted with the same type of engine, viz., the Thornycroft 40-H.P. motor, of which the following are the chief features:—Four cylinders, cast in pairs, 4½ in. bore by 6 in. stroke. The valves are arranged on opposite sides of the cylinder head and are all interchangeable. All valves are readily accessible through the quick casting bayonet-jointed cover, which is a special feature of the Thornycroft engine. The camshafts are driven, by means of single helical cut gears, from the crankshaft. The gear on the inlet camshaft forms the spider for the governor, which is therefore totally enclosed in the crank case.

The magneto, through a third shaft parallel to the crank and camshafts, is driven by a single helical pinion gearing with the exhaust camshaft wheel. The fan and the centrifugal circulating water pump are operated by means of a "V" belt from a pulley mounted upon an extension of the magneto driving shaft.

The circulating water pipes are as large as for thermo-syphon cooling, in this way minimising the resistance against the pump and providing sufficient area to run under temporary and restricted conditions in case of failure of fan and pump belt, etc.

Lubrication is by means of a rotary pump mounted upon the front end of the exhaust camshaft, kept primed by a special self-priming box mounted alongside the pump. The pump forces oil to all bearings on the crank shaft, and lubricates other parts by the splash from bearings and large ends of the connecting rods. The pressure of oil in the pipes is regulated by a relief valve mounted upon the timing gear case, so that the overflow lubricates the gearing.

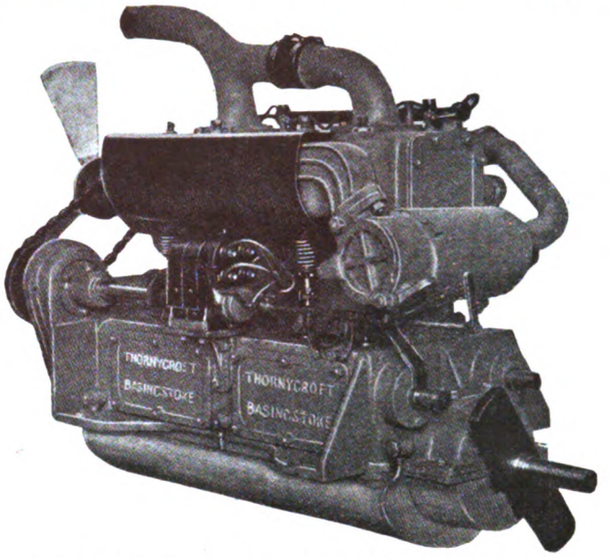

Fig. 2.—Thornycroft Four-Cylinder 40-H.P. Engine.

In our illustration the engine is shown fitted with the Thornycroft kerosene vaporiser (Fig. 2). Although intended chiefly for use on colonial models, this vaporiser has given most satisfactory results on each of the three heavy-type machines to which it has been fitted in considerable numbers.

Messrs. Thornycroft's works at Basingstoke are admirably suited for the construction of motor vehicles in large quantities. The

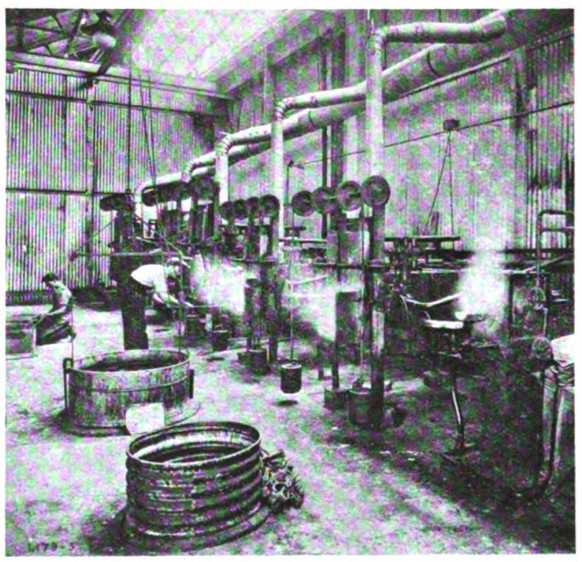

Fig. 3.—The Case-hardening Plant.

system upon which the resources have been developed during the war, in order to meet the great demands of the Government departments, has so perfected the progressive stages of construction that the works have become one of the most important industrial motor factories in this country. The organisation for the reception of visitors had been so perfected that the party were able, during their tour of the works, to trace the progressive stages of manufacture

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from the time of the entry of raw material into the works until the final testing of the completed chassis.

A noteworthy feature was the varied stocks of raw material, which are carefully graded and stored in proximity to the workshops. It is this careful selection, in conjunction with the special processes of treatment in the course of manufacture, that plays such an important part in the life of the modern motor vehicle. As indicating the changes that have taken place during recent years on

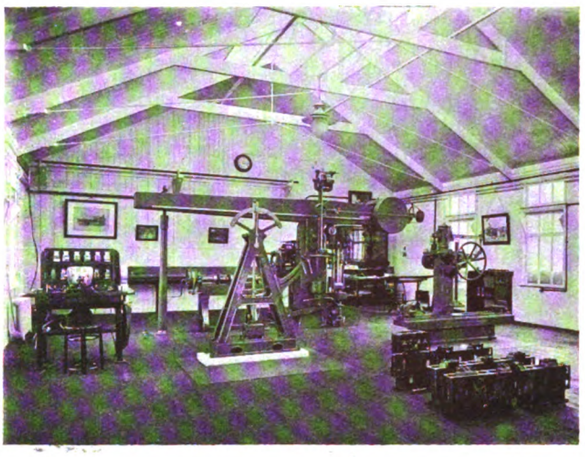

Fig. 4.—View of Laboratory showing Mechanical Testing Machines.

this question of selection of material, Sir John Thornycroft, who personally conducted the party of visitors, remarked that at one period steel was steel, but to-day there was a special grade of steel for practically every component part of a machine.

In the timber store, which has a capacity for some £80,000 of wood, natural drying has been arranged for, but owing to the present difficulty of obtaining a sufficient quantity to allow for this, the company are installing apparatus for artificial drying Throughout the works the visitors were much impressed with the cleanliness and spaciousness of each of the departments. All the floors are of concrete. Even in the smithy the atmosphere was perfectly clear, and the shops well lit. Each hearth is connected to a system of exhaust pipes, which remove all smoke and fumes. Complete installations for electric welding, acetylene welding, and die casting are also housed in the smithy. The latter operation was watched

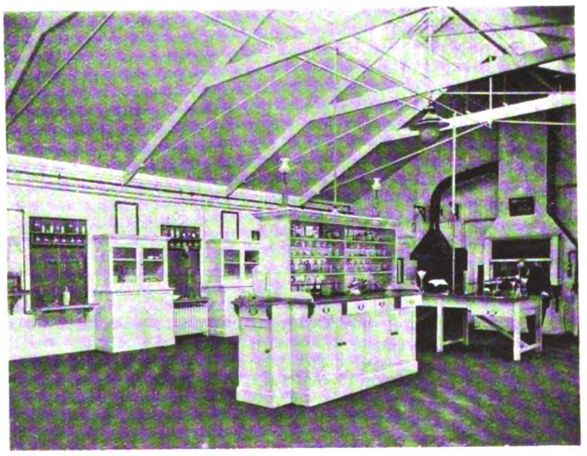

Fig. 5.—The Laboratory showing Chemical Testing Appliances.

with interest by the visitors, finished white metal bearings being produced without machining.

A well-equipped case-hardening shop (Fig. 3) is run on producer gas, the gas plant being fed entirely by waste from the body-building shop, together with the sawdust and waste wood from the saw mills.

Coming to the engine shop, in addition to a large number of the standard 40-H.P. vehicle motors, the visitors were shown a number of coastal motor-boat engines, for which Messrs. Thornycroft have earned a world-wide reputation.

In the erecting shop some 80 chasses in various stages of completion were seen. The visitors were here given an excellent opportunity of examining in detail each component part, the method of assembly together, and the accuracy of adjustment. Messrs. Thornycroft have their own body-building shops and are, therefore, able to supply complete vehicles built to any requirements. This shop is equipped with the latest wood-working machinery. Entering the paint shop, a number of finished vehicles were shown, some striking examples of colour combination being seen.

Remembering that the reduction of dead weight in vehicles is of primary importance, it follows that accurate knowledge of the nature and strength of the material used in construction is essential. In order to obtain this in the fullest sense, Messrs. Thornycroft have an exceptionally well-equipped laboratory, views of which are reproduced in Figs. 4 and 5. Here chemical and mechanical tests are carried out in a manner that ensures the use of only the most suitable material. In planning the Basingstoke works Messrs. Thornycroft have paid every attention to the comfort and convenience of the staff. The offices are large and airy, while the commodious mess rooms with their up-to-date cookery appliances are all that could be desired.

The visitors were given an opportunity of taking part in a hill climbing test by a number of the " X " type vehicles destined for the India Government. This was carried out on the long ascent of Farley Hill, where the gradient at one place is 1 in 7. The vehicles ascended the hill in good style, and on the return gave a remarkable exhibition of the efficiency of the brakes.

An item of added interest to the visit to Basingstoke was a demonstration of the Thornycroft trench mortars and depth charge thrower, which had been arranged in Hackwood Park, adjacent to the town. This particular type of gun was designed and manufactured by Messrs. Thornycroft, and large numbers have been supplied to the Army and Navy. It is understood that the success of the submarine chasers with regard to depth charge dropping can be largely traced to the efficiency of the Thornycroft thrower. Now that the period for the termination of war work has been reached, the well-organised works and highly efficient staff will be able to cope with the daily increasing demand for Thornycroft vehicles.

THE FUTURE OF GAS TRACTION.

In an address on " Gas Traction Development " at Manchester College of Technology, on the occasion of the exhibition of a gas-propelled chassis, Mr. E. S. Shrapnell-Smith, secretary of the Inter-Departmental Committee on Gas Traction, spoke of the disappointment caused by the placing of gas under control. The case for gas traction had not, he said, been inherently prejudiced by the war-time difficulties of 1918. The requirement for gas permits ceased on Friday, January 10, after which date gas could be used for traction purposes by anybody who could obtain it. In years to come it would be necessary to secure the utmost production of every class of motor fuel, as there was a limit to the world's output of petrol, but not to users' requirements. The portents were in favour of the continued and extended use of gas, on a competitive basis in the first place, and, by degrees, on the ground of equal convenience, no matter what liquid fuels might be offered.

BATTERY VEHICLES IN NEW ZEALAND.

Mr. L. Birks, electrical engineer to the Public Works Department, Christchurch, reports that electric road vehicles have proved their adaptability to various phases of transport, and aroused a strong demand for a more liberal supply of vehicles. In Christchurch alone there are 20 lorries, and a dozen vehicles are on the way out, including several repeat orders.

New Zealand is on the eve of big developments in hydro-electric power supply. "Already," says Mr. Birks, "every farmer in this district is clamouring for a supply of electricity, and battery charging stations will be established in every available situation." The Rongotea Dairy Company estimate that electrics are effecting a saving of £1 10s. per running day as compared with the cost of operating petrol vehicles at the present time.

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DEPARTMENTAL COMMITTEE ON ROAD LOCOMOTIVES AND HEAVY MOTOR VEHICLES.

RECOMMENDATIONS REGARDING CONSTRUCTION AND USE. A DIFFERENCE WITH SCOTLAND YARD ON OMNIBUS SPECIFICATIONS.

The report of the Departmental Committee appointed by the President of the Board of Trade to consider the Law and Regulations relating to the Construction and Use of Road Locomotives and Heavy Motor Cars was issued in January, together with a voluminous Blue Book containing the evidence taken before the Committee. We now publish an extended summary of the report, which was briefly referred to in our issue of January 16. The Committee, which was appointed in March, 1915, consisted of Messrs. E. Shortt, K.C., M.P., A. G. G. Asher, W.S., P. M. Crosthwaite, M.Inst.C.E., H. H. Humphreys, M.Inst.C.E., E. J. Lovegrove, M.Inst.C.E., J. E. Thornycroft, A.M.Inst.C.E., and J. Willmot, F.S.I. Mr. Shortt acted as chairman, and Mr. R. J. Simpson was the secretary.

The report comprises 35 pages, the volume of evidence, with appendices, 388 pages. Twenty-seven meetings were held and 66 witnesses were examined. A sub-committee appointed to examine evidence, etc., in detail, held eleven meetings. In addition to representatives of Local Government Authorities, witnesses were heard from the Tramways and Light Railways Association, National Traction Engine Owners' and Users' Association, Steam Cultivation Development Association, Society of Motor Manufacturers and Traders, Commercial Motor Users' Association, London General Omnibus Company, British Electric Traction Company, etc. Evidence was also received from certain Government Departments. The views of the Commissioner of Police upon suggestions relating to the construction of motor omnibuses and other matters were put before the Committee by Superintendent Bassom. The Committee invited certain of the railway companies and the Scottish Motor Traction Company to appoint representative witnesses, but the invitation could not be accepted owing to conditions arising out of the war.

In the narrative of the "Course of the Proceedings" the Committee mention that among the demonstrations they witnessed were tests designed to show the surface resistance of different kinds of roads, which tests were arranged and carried out by the London General Omnibus Company, to whom they desire to express indebtedness for their courtesy in providing the demonstrations and tests and for the thoroughness with which they were carried out.

DAMAGE TO ROADS AND CAUSES OF DAMAGE.

In the course of their "General Observations upon the Evidence," the Committee say:—Certain general principles have emerged clearly. In the first place, heavy mechanically-propelled traffic, both for passengers and for goods, has developed very largely in the last few years, will in all probability still further develop, and must be recognised as playing a necessary and an increasing part in the commercial and industrial life of the nation. In the second place, such traffic is to a very considerable extent no longer local in its character, and in framing laws and regulations for its control due regard must be had to the extended nature of its operations. In the third place, it has been made clear (i.) that it is possible to construct and maintain roads capable of carrying the traffic efficiently at a cost which, if equitably adjusted, would not be unreasonable; and (ii.) that as the traffic grows, and becomes less local in its character and more extended in its operations, so it will become more and more necessary to treat the roads which carry such traffic less from the local standpoint and more in accordance with its extended character, with respect both to cost and to control and administration.

It has been shown conclusively that, in a number of districts, damage has been caused to the roads by the traffic in question, and that a number of local authorities have been put to considerable additional and unfair expense. Many suggestions have been made by witnesses who spoke on behalf of county, borough, and district councils, tramways companies, and road authorities generally for mitigating the injury done to the roads. The principal suggestions can be conveniently divided into two classes:—(i.) Those dealing with the weight, construction and speed of the vehicles; and (ii.) those dealing with choice of route, bye-laws, and the general control of the roads and traffic by central and local authorities.

In considering the effect of heavy traffic on the various kinds of road construction, it is necessary to distinguish between the effect of locomotives and heavy motors tired with iron, steel, or other hard material, and the effect of those which are rubber tired, including motor omnibuses, or tired with some other soft or elastic material.

In setting forth the principal causes of alleged damage to roads, the Committee add:—In addition, special damage is attributed to motor omnibus services by reason of (1) the regularity of the service, namely, the constant passage over a road of vehicles of identical construction, and the frequent stopping and starting of the omnibuses, often at fixed points along the road; and (2) the "character of the load" and the springing of the vehicle.

SUMMARY OF RECOMMENDATIONS.

The Committee's summary of their recommendations is as follows:

Road Locomotives: Weight, Construction, and Speed.

(1) The maximum limit of weight of 14 tons should remain unaltered as regards ordinary road locomotives, and should be raised to 18 tons in the case of the Boulton wheel traction engine. The expression "weight" should be more clearly defined.

(2) The licensing authority should be required to ascertain the correct weight of a locomotive by causing the locomotive to be weighed before it is licensed or registered.

(3) Certain amendments should be made in the provisions of Section 28 of the Highways and Locomotives (Amendment) Act, 1878, which prescribe the width of the tires of the wheels of locomotives. A locomotive should be prohibited from carrying a load of goods or merchandise.

(4) The provisions of the same section authorising the use of diagonal crossbars upon the driving wheels of locomotives should be amended by prescribing the angle at which the crossbars should be affixed.

(5) Locomotives should be constructed with springs, except in certain cases.

(6) Existing locomotives should be exempted from compliance with any new requirements as to construction.

(7) The statutory provisions regulating the weights to be carried upon wagons drawn by locomotives should be repealed, and new regulations substituted, based upon those applicable to vehicles drawn by heavy motor cars.

(8) A highway authority should be notified in advance of the passage over a road in its area of a traction engine hauling a wagon which carries a single article exceeding 16 tons in weight.

(9) The speed at which a locomotive is permitted to travel when passing through any city, town, or village should be increased from two miles an hour to three miles an hour.

(10) The powers of the Local Government Board should be extended so as to enable the Board to increase the weight of the Boulton wheel engine, and to permit the use of new and improved types of locomotives.

Heavy Motor Cars: Weight, Construction, and Speed.

(11) The maximum unladen weight of a heavy motor car should be increased to 6 tons, and the combined unladen weight of the car and trailer should be increased to 8 tons.

(12) The definition of the unladen weight of a motor car should be amended.

(13) The maximum laden weight and the maximum axle weight should not be altered.

(14) Before a heavy motor car is registered, it should be weighed by or in the presence of an officer of the registering authority and its correct unladen weight definitely ascertained, and the registering authority should be required to satisfy themselves that the correct weights and speed are marked on the car. The registering authority should be authorised to require a motor car to be weighed, upon an application for registration, if the declared weight of the car unladen does not exceed 2 tons.

(15) The distance which a heavy motor car may be required to be driven to a weighing machine for the purpose of testing the axle weight should be increased to one mile, and registering and road authorities should for this purpose be empowered to require a car to be driven to a weighing machine from any distance beyond the one mile limit, subject to provisions as to the payment of compensation and the delivery of a certificate of weight. Heavier penalties should be imposed in the case of habitual offenders against the regulations limiting axle weight.

(16) The minimum diameter for wheels of heavy motors fitted with iron, steel, or other hard tires should be raised from 2 ft. to 2 ft. 9 in., and a scale of minimum diameters should be prescribed, according to registered axle weight, where the registered axle weight exceeds four tons.

(17) The edges of a tire of iron, steel, or other hard material should be rounded. Bevelled edges should not be permitted.

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In other respects the regulations relating to the use of this description of tire should not be altered.

(18) The diameter of any wheel of a heavy motor, which is fitted with a solid rubber tire or other tire of a soft or elastic material, not being a pneumatic tire, should not be less than 2 ft. 6 in. No regulation need be made as to the size or shape of the tire itself.

(19) The maximum overall length of a heavy motor car should not exceed 26 ft. The overhang behind the driving axle should not exceed seven twenty-fourths of the overall length of the car. These requirements should apply to motor omnibuses.

(20) Heavy motor cars registered and in use before amending regulations come into operation should be exempted from compliance with any new requirements as to construction, and the loads which such cars are at present permitted to carry should not be reduced.

(21) The existing law, which permits a motor car to be used to draw one trailer only, should be retained. Certain minor amendments should be made in the regulations relating to the use of trailers.

(22) The present speed limit regulations should be retained, subject to the following amendments, namely, (*a*) that the speed for a heavy motor car tired with iron, steel, or other hard substance should not in any case exceed five miles an hour, and (*b*) that where a heavy motor car draws a trailer and the wheels of both vehicles are fitted with rubber tires, the maximum speed should be eight miles an hour.

(23) Heavier penalties should be imposed for a second or subsequent offence against the speed limit regulations.

Restriction of Heavy Traffic on Unsuitable Roads.

(24) Motor omnibus and similar passenger traffic should be brought under special regulation, and the procedure should be that laid down in Section 20 of the Local Government (Emergency Provisions) Act, 1916.

(25) Powers should be conferred on the Local Government Board and the road authorities to regulate through heavy motor traffic in order to secure that such traffic is, as far as practicable, required to use the roads which are constructed to carry it.

(26) County Councils should be given power to regulate traffic upon a road which is under repair or reconstruction, and to divert the traffic on to another road.

Special Questions.

(27) The question of legalising the use of self-propelled vehicles constructed on the wheelless pedrail system should be further considered when the opportunity arises.

(28) The law relating to heavy motor cars should not be extended so as to authorise the use thereunder of road trains.

(29) Steps should be taken to deal with the question of requiring heavy motor cars to be provided with lifeguards.

(30) The law need not be amended so as to require drivers of road locomotives to be licensed.

(31) The provisions of the Town Police Clauses Acts, 1847 and 1889, so far as they relate to the licensing of motor omnibuses, should be reconsidered with a view to their revision in certain respects.

(32) The existing provisions with regard to the emission of smoke or visible vapour from locomotives or motor cars should be repealed, and in lieu thereof it should be made an offence to cause or permit the emission of smoke or visible vapour from a locomotive or motor car on a public highway in such quantity as to be a nuisance or danger to the public.

(33) The bye-law requirement as to the provision of means of communication between the rearmost wagon of a train of wagons drawn by a locomotive and the driver of the locomotive should be made a statutory requirement. A heavy motor car should be required to carry a mirror whereby the driver can see overtaking traffic.

(34) The existing law should be amended so as to provide more effective measures for securing the strengthening and improvement of bridges which do not meet the requiements of heavy self-propelled traffic, and to ensure the removal, and prevent the imposition, of unnecessary restrictions upon the use of bridges by such traffic.

(35) The various suggestions relating to the question of extraordinary traffic should be considered in connection with any amendment of the law on this matter.

(36) Public funds should be made available to encourage the design and construction of heavy mechanically-propelled vehicles calculated to cause less damage to the roads and facilities given for trials and demonstrations of self-propelled vehicles which cannot ordinarily be used on the public roads without breach of the law.

(37) The law should also be amended to give effect to certain suggestions of a minor character.

(38) The law should be simplified and consolidated.

The Committee treat each of the foregoing 38 recommendations in detail.

HEAVY CARS—MAXIMUM LADEN WEIGHT AND AXLE WEIGHTS.

There is no evidence, the Committee remark, to show that the road authorities generally consider that the present maximum weights of 12 tons for the total laden weight of the heavy motor car, 8 tons for any axle of the car, and 4 tons for any axle of the trailer, are too high for good class roads. One or two surveyors are disposed to allow some slight increase provided that their suggestions as to wheel construction are carried out, whilst another surveyor favours a considerable increase. The views of manufacturers and users differ; generally their witnesses desire some increase, but one witness considers that no increase is required.

The evidence as to the state of the roads and the damage caused by heavy motor traffic was given before the full effect of war conditions had been experienced. Upon this evidence we should have felt considerable hesitation in recommending any increase of the maximum laden weights. But in view of the deterioration in the surface of a very large mileage of important roads, which has taken place during the last two years and still continues, due, on the one hand, to the great volume of traffic serving military and other national requirements, and, on the other hand, to the inadequate supply of labour, materials, and money required for works of road maintenance, we are very strongly of opinion that no increase in the laden weights should, for the present, be allowed.

It seems to be established beyond question that the carrying of loads in excess of the legal limits is a common occurrence, and there is reason to suppose that the weights declared on registration and marked on the cars are sometimes incorrect. We are satisfied that an appreciable amount of the damage caused to roads may properly be attributed to these practices, and that it is desirable to strengthen the hands of the road authorities, and to emphasise the need for greater accuracy and a more general use of their powers for dealing with overloading. (Recommendations 14 and 15.)

The considerations which render necessary the use of wheels of larger diameter for iron and steel tired motors apply, though with less force, to the rubber-tired vehicle. Several witnesses have suggested that in this case also a minimum diameter should be prescribed, and have mentioned sizes varying from 2½ ft. to 3 ft. We are satisfied that the roads would benefit considerably if the use of wheels of small diameter were prohibited, and we recommend that a new requirement should be imposed to the effect that the diameter of any wheel which is fitted with a tire of a soft or elastic material, other than a pneumatic tire, should be not less than 2 ft. 6 in., inclusive of the tire. As such a requirenent will apply to wheels of vehicles when in actual use, whether the wheels be shod with new or worn tires, it will in practice entail a slightly larger diameter when the tire is new, so as to allow for the reduction in size of the diameter due to the wear of the tire. For the purpose of the requirement, the size of diameter should be ascertained by horizontal measurement. (Recommendation 18.)

Objection is taken to the use of the twin solid-rubber tire on the ground that it does more damage to the road than the single tire. It appears to us that the only special damage which can be attributed to the twin tire is due to some displacement of road material which is forced into the space between the two tires as they expand towards each other—the "pinching" action of the tires—and that this process can only occur on a road the surface of which is not firm enough to withstand the expansion and contraction of the tire. The twin tire secures a larger contact area than could be expected to be obtained by the use of the single tire, given the same axle load. We are disposed to agree with the witness who claimed that the interests of the tire maker are so closely identified with those of the road maker that it can safely be left to the former to produce the best possible tire.

LENGTH, WHEEL BASE, AND OVERHANG.

There is no regulation dealing with any of these matters in the Heavy Motor Car Order. A tendency has grown up to bring the back wheels as far forward as possible in order to obtain a better thrust or drive. This tendency has been condemned on account of the damaging results it has upon the road. It throws an undue proportion of the total laden weight upon the driving axle, and is in part responsible for contraventions of the regulations limiting axle weight which we have referred to. In addition, it increases the swinging motion at the rear of the vehicle, and consequently the force of the impact when the vehicle is passing over an uneven road surface. Consideration of the evidence referred to has convinced us of the need for regulating the position of the driving axle, and we recommend that the following requirements be imposed:—

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(i.) The maximum overall length of a heavy motor car shall not exceed 26 ft.

(ii.) The overhang behind the rear axle (in practice the driving axle) shall not exceed 7/24ths of the overall length of the car. (Recommendation 19.)

We have also considered whether a further requirement ought to be imposed to the effect that the wheel base of a heavy motor car should be of a prescribed minimum length proportionate to the overall length of the vehicle. We are of the opinion that it is more important to regulate the overhang behind the driving axle, as recommended in (ii.) above, and that the adoption of this recommendation would make it unnecessary to lay down any definite rule as to the length of the wheel base.

EXEMPTIONS FROM STRUCTURAL REQUIREMENTS.

We do not consider that it would be reasonable to require that heavy motors, which have been constructed in compliance with the existing regulations, should conform with any amending regulations made to give effect to our suggestions respecting the compulsory use of larger wheels, the length of the vehicle, and the overhang behind the driving axle; neither do we think that the new regulations should have the effect of reducing the loads which such motors would otherwise be permitted to carry. (Recommendation 50.)

WEIGHT AND CONSTRUCTION OF THE LONDON MOTOR OMNIBUS.

Motor omnibuses licensed in the Metropolitan Police Area are required to comply with the conditions laid down by the Commissioner as the licensing authority. These conditions are in many respects more onerous than the restrictions contained in the Heavy Motor Car Order, and deal with matters not covered by that order. Full and detailed evidence was given by Mr. Iden, then chief engineer of the London General Omnibus Company, with regard to these conditions, so far as they bear on the question of road damage, and the measures taken by the company to comply with them.

The chief engineer suggested that an addition of 10 cwts. should be made to the unladen weight of the motor omnibus permitted in the Metropolitan Police Area, namely, 3½ tons. He pointed out that the addition of that 10 cwts. would enable the omnibus to be constructed with a longer wheel base (although still well within the limit allowed by the Metropolitan Police), longer springs, and a deeper tire, the result of which would be to decrease substantially the damage done to roads by the motor omnibus services.

The Metropolitan Police strongly object to any increase of weight on the score of vibration, but it appears to us to be probable that any increase in vibration, which would ordinarily be due to an increase in weight, would be largely counteracted by the structural alterations suggested.

We are very strongly of opinion that these suggestions, if carried out, would be beneficial to the roads. But it appears clear from the evidence that, taken together, they will entail an appreciable addition to the weight of the omnibus, and we have refrained from definitely recommending the adoption of the suggestions in their entirety on the ground that the introduction of a substantially heavier omnibus might tend to increase the number and severity of accidents in the streets. We nevertheless consider that, as regards future construction, the London motor omnibus should be required to conform in the matter of overhang behind the driving axle with the new requirement suggested in paragraph 49, even if the structural alterations thus entailed will involve some increase in the weight of the omnibus.

TRAILERS AND PASSENGER HAULAGE.

It has been suggested that the existing law, which provides that a motor car shall not be used to draw more than one trailer, should be relaxed, so as to enable a motor tractor to be used to draw two trailers. We consider that the existing law should be retained; where more than one trailer is hauled, the motor tractor should be treated in law as a "locomotive." (Recommendation 21.)

Among other suggestions is one that the existing prohibition against the use of trailers behind passenger-carrying heavy motors should be relaxed so as to admit of the use, subject to conditions, of trailers carrying passengers or of trailers carrying luggage. The use of such trailers would, in our opinion, be likely to constitute an additional element of danger upon the public highway, and should not be allowed.

SPEED—REGISTERS AND ENGINE GOVERNORS.

It is clear from the evidence that the speeds at which damage is most frequently caused are speeds which are in excess, and often greatly in excess, of the legal limits. We have received a number of proposals for altering the present limits. There is nevertheless a considerable body of opinion amongst road surveyors in favour of the retention of these limits. The proposals referred to include the following:—

(*a*) Those made by the representatives of Metropolitan Councils, advocating the reduction of the present limit for omnibuses of 12 miles an hour to 10 miles an hour, and as regards other rubber-tired traffic, the reduction of the present limits of 8 and 12 miles an hour to 5 and 8 miles an hour respectively.

(*b*) The proposals made on behalf of users for various speed limits ranging from 6 miles an hour to 20 miles an hour, according to weight, type of tire, and whether or not a trailer is drawn.

(*c*) The proposal of the London General Omnibus Company that the limit for motor omnibuses should be raised to 16 miles an hour. (Evidence of Sir Albert Stanley.)

After a careful consideration of all the evidence, we have come to the conclusion that it would not be desirable to make any drastic alteration of the present regulations. The proposals made on behalf of the Metropolitan Councils, if adopted, would in our view have the effect of seriously increasing the congestion of traffic, and on this ground alone the proposals appear to be inadmissible. Whilst we do not consider that the proposed increase of the speed of the omnibus to 16 miles an hour would have a serious effect upon properly constructed paved roads in the metropolis, it would undoubtedly increase the damage done to other roads, and give rise to complaints of vibration. We are also unable to satisfy ourselves that such an increase of the speed limit would not lead to more serious and more frequent accidents. (Recommendations 22 and 23.)

The other suggestions relate to the compulsory use of mechanical devices designed either—

(*a*) To register the speed of the car; or

(*b*) To notify to persons on the highway that the car is exceeding the speed limit; or

(*c*) To automatically restrict the speed of the car to its legal limit.

These devices appear to be either unreliable in practice or open to some other objection. As regards speed registers, or speed indicators, these would, if effective, help a law-abiding driver to keep within the law, but they would seem to be of little value in the case of a deliberate offender. With regard to appliances for giving audible warning of illegal speed, there is no evidence that an efficient appliance exists, and witnesses differ as to the advisability of using such appliances, some contending that these would prove to be a public nuisance. The third class includes engine governors arranged so as to limit the speed to a fixed maximum. The evidence as to the practicability or otherwise of some compulsory mechanical limitation of speed does not seem to be conclusive. It would not appear to be essential that the mechanical limitation should come into operation at the legal maximum speed; some margin might be allowed to enable the vehicle to slightly exceed the legal maximum in order to avoid accidents and to maintain a reasonable speed when ascending a hill or in other unfavourable conditions. If it can be shown that some suitable arrangement for mechanically limiting the speed is practicable, it would seem that the circumstances would warrant its compulsory adoption, but there is no evidence which would justify us in reporting that any such arrangement exists.

RESTRICTION OF HEAVY TRAFFIC ON UNSUITABLE ROADS.

The need for some measure of control over heavy motor traffic, particularly omnibus traffic, which would enable the road authorities to safeguard roads unfitted for such traffic, has been very strongly urged. Witnesses for the road authorities differ as to the form which such control should take. One suggestion is that notice should be given to the road authority of any proposal to establish a service of heavy motors, and that the road authority should be empowered to prohibit the service subject to an appeal to the central authority. A further suggestion commonly put forward is that road authorities should be authorised to prescribe the routes for motor omnibuses. The general opinion of witnesses for the motor manufacturers and users appears to be that any further restrictions upon heavy motor traffic, aiming at the protection of inferior roads, should be confined to restrictions upon speed. Whilst the London General Omnibus Company are opposed to any system of control which would entitle a road authority to impose conditions or to exact bargains in connection with the establishment of a new route, they appear to be willing that the road authority should be given the right to object to a proposed service, and that the final determination should rest with a central road authority.

It has been represented by witnesses that motor omnibus and similar passenger traffic should not be singled out for special regulation, but it seems to us that a distinction can fairly be drawn somewhat on the following grounds:—

(*a*) Motor omnibuses are already subject to control as public service vehicles under the Acts requiring omnibuses plying for hire to be licensed; trade motor vehicles are not subject to similar control. (*b*) Motor omnibuses plying for hire normally follow a defined route, and the use of roads generally is not essential to their requirements. On the other hand, trade motor vehicles require the use

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of all classes of roads. (*c*) Motor omnibus traffic is in a greater degree than trade heavy motors the cause of the sudden damage to roads which it is desired to prevent. (*d*) A motor omnibus service, by reason of the regularity of the service, the more or less continuous passage over the road of a number of vehicles of identical construction, the numerous stoppings and startings, and certain characteristics of the vehicles, does special damage.

We think that the evidence which has been given as to the serious damage caused to a number of roads by motor omnibus traffic, and the very heavy expenditure entailed in improving those roads to render them fit for the traffic, goes far to prove that omnibus traffic is exceptional in character, presents special difficulties to highway authorities, and requires special treatment. We are of opinion that much of the damage and expenditure might be avoided if there existed between the omnibus companies and the highway authorities, both local and central, the closer co-operation which may be expected to result from placing omnibus traffic under control. With closer co-operation it should often be found possible to abstain from using a road which is known to be unfitted for the traffic, or if such a road must be used, to carry out the necessary works of improvement before the service has commenced, and consequently under more favourable conditions and at less cost.

We accordingly recommend that motor omnibus and similar passenger traffic be brought under special regulation, and that the procedure be that laid down in Section 20 of the Local Government (Emergency Provisions) Act, 1916, namely, existing omnibus routes to be left untouched, and new routes to be established with the consent of the highway authority, or, if that consent is refused, or is given subject to unreasonable conditions, with the consent of the Local Government Board. (Recommendation 24.) In recommending that this enactment be made permanent, so far as it relates to omnibuses, we desire to make it clear that we have not thought it necessary to consider this enactment in connection with any questions relating to contributions by omnibus traffic towards road maintenance, since we have understood that these questions are to be dealt with by another committee.

The second case of unreasonable use of roads to which we referred can, we think, be largely met by a scheme regulating through heavy motor traffic. (Recommendation 25.)

ROAD TRAINS—LIFEGUARDS—SPLASHGUARDS.

From the point of view of road damage, the use of a road train constructed in accordance with the Thomas transmission system appears to us to be sound in principle, since the driving effort, which in the case of an ordinary self-propelled vehicle drawing one or more trailers is concentrated on two driving wheels, is under this system distributed over a series of driving wheels. The proposal is to allow the use on the roads of trains constructed on this principle made up of three, four, or five vehicles, having a maximum moving weight of 42, 56, and 70 tons respectively, and permitted to travel at maximum speeds of 12, 11, and 10 miles an hour. The proposal represents a very great advance upon anything that has hitherto been permitted. It appears to us to be very doubtful whether road trains, such as suggested, could properly be allowed on roads generally, and after carefully considering the matter we are not prepared to recommend that their use should be legalised. (Recommendation 28.)

No progress appears to have been made towards the solution of the problem of the front guard. The side guard of the "inswept hurdle" type, the use of which on London motor omnibuses is now, under police regulations, compulsory, appears to be satisfactory; and the only question is whether that type of side guard can be extended to heavy motor cars generally or to some recognised classes of heavy motor cars. The London motor omnibuses being practically uniform in construction, can carry side guards of a uniform type; but the question is much more complicated when considered from the point of view of the great diversity in the construction of heavy motors generally. We recognise the difficulties of dealing satisfactorily with this problem, and we recommend that steps should be taken to overcome those difficulties, and to secure that heavy motor cars are provided with suitable and sufficient lifeguards. (Recommendation 29.)

Complaints have been made to us as to the serious nuisance arising from mud-splashing. It appears to be desirable that, at any rate in the case of heavy motors permitted to travel at the higher speeds, the use of splashguards should be compulsory as soon as an efficient splashguard is available. Investigations and experiments have been conducted by the users and the Metropolitan Police with regard to several types of splashguard, but have not resulted in the discovery of one likely to prove sufficiently suitable to justify its general adoption.

LICENSING OF MOTOR OMNIBUSES.

Motor omnibuses plying for hire are required to conform not only with the law and regulations applicable to them as "motor cars," but also with the statutory provisions, regulations, or by-laws applicable to them as "stage carriages" or "omnibuses," and in force in the area or areas in which they ply for hire. As regards the metropolis, no objection appears to be taken by any witness to the present system under which the power of licensing motor omnibuses and their drivers is exercised by the police.

It is suggested on behalf of the County Councils that those Councils should be the licensing authorities either for the rural areas in the administrative county or for the whole of the administrative county. The London General Omnibus Company also favour the transfer of the powers to the County Councils, though they desire to limit the powers of the licensing authority to the mere granting of the licence, subject to an appeal to the Local Government Board in case of refusal, and suggest that the conditions and regulations governing the issue of licences should be uniform throughout the provinces, and should be framed by the Local Government Board. The company complain that under the existing system the licensing authorities make improper use of their powers to impose arbitrary conditions or exact bargains, amounting in some cases to virtual prohibition of omnibus services and rendering through services impossible.

The provisions which govern the licensing and regulation of motor omnibuses in the provinces were enacted to meet the case of horse-drawn omnibuses, whose operations would ordinarily be limited to a particular town and its vicinity, and it is hardly surprising to find that they do not work well when applied to a long-distance motor omnibus service linking up several towns, each of which may be a separate licensing area. We are of opinion that these provisions, so far as they apply to motor omnibuses, motor coaches, and motor chars-a-bancs, require reconsideration in the light of modern requirements, and that attention should be given to the following points:—

(i.) The need for a more uniform system of licensing, which would make it unlawful for motor omnibuses to ply for hire anywhere in the provinces unless a licence has been obtained.

(ii.) The need for a wider local unit of administration, corresponding with the wider radius of action of the motor omnibus.

(iii.) The question of giving a right of appeal to the Local Government Board against a refusal of the licensing authority to grant a licence. This question has a direct bearing upon our recommendations with regard to the regulation of motor omnibus traffic. If, upon an appeal to them under Section 20 of the Local Government (Emergency Provisions) Act, 1916, the Local Government Board have consented to the establishment of a motor omnibus service, it seems to us clearly undesirable that the licensing authority should still be able to prohibit the service by withholding its licence. (Recommendation 31.)

BRIDGES.

Attention is drawn in the evidence to the serious handicap to heavy traffic resulting from the presence on public roads of railway, canal, and other privately-owned bridges, which are not of sufficient strength to carry such traffic, and to the failure of the existing law to provide effective measures for securing that these bridges are strengthened to meet the requirements of the traffic. The need for amendment of the law is rendered more urgent by the recent decisions of the House of Lords in the case of Sharpness New Docks and Gloucester and Birmingham Navigation Company *v.* Attorney-General and Attorney-General (in the relation of Pickfords, Limited) *v.* the Great Northern Railway Company, the general effect of which is that the standard of maintenance of a particular bridge is determined by the conditions prevailing at the time the bridge was originally built, and that the railway or canal company are under no obligation to increase the strength of the bridge to enable it to carry the heavier traffic due to the growth and development of road transport.

We are of opinion that the public demand for improved facilities for road transport requires that the Local Government Board, and, in the case of railway bridges, the Board of Trade, should have more direct control than is given by the present law and regulations, so as to secure that heavy motor traffic is not hampered by restrictions on the use of bridges, which are not in fact necessary. We also think it desirable that the provisions affecting locomotives and those affecting heavy motors should be more uniform in character. We consider that the law and the regulations should be amended so as to provide—

(i.) That in future no restrictions should be placed upon the use of a bridge on a public highway except by by-law made by the Council of the county or borough in whose area the bridge is situate, and confirmed by the Local Government Board.

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(ii.) That if the local authority refuses to make a by-law in respect of a bridge which the local authority is not liable to repair, the person liable to repair the bridge should be given a right to appeal against such refusal to the Local Government Board.

(iii.) That a heavy motor owner should have the right to appeal to the Local Government Board, or to the Board of Trade in the case of a railway bridge, against any by-law made under Section 1 of the Act of 1896, or any prohibition imposed under the Heavy Motor Regulations.

(iv.) That where any restriction is placed on the use of a bridge by a locomotive or by a heavy motor car, whether by by-law or otherwise, the by-law-making authority or the person liable for the repair of the bridge should be required to exhibit on the bridge and at suitable places such as road junctions, on the roadways leading to the bridge, notices indicating the restriction imposed. (Recommendation 34.)

The above suggestions, so far as they relate to heavy motor cars, follow substantially the recommendations made by the Royal Commission on Motor Cars.

EXTRAORDINARY TRAFFIC.

The question of extraordinary expenses due to damage caused by excessive weight or extraordinary traffic has been discussed before us at considerable length, and various suggestions have been made for amending the law and procedure relating to this question. The object of the extraordinary traffic provisions is not to prohibit the traffic, but to put upon the individual responsible for it the extra cost which the traffic occasions.

After expressing disagreement with various suggestions put before them, the Committee proceed :—Other suggestions, made with the view of meeting some of the difficulties arising out of the extraordinary traffic provisions, are :—

(*a*) That before traffic which is recognised by both parties as extraordinary commences there should be an agreement between the parties for strengthening the road to carry the traffic and for apportioning the cost, and, failing agreement, some independent authority should settle the terms. This proposal appears to have been generally accepted by the users.

(*b*) That the road authority should be empowered to apply to the court to appoint a person to inspect the road before the traffic which the road authority considers may be extraordinary commences, during its continuance, and after it has ceased, and to report on the condition of the road.

These suggestions appear to us to be valuable. If the law does not enable voluntary agreements of the kind suggested to be made and enforced, it should, we think, be amended. We further recommend that the proposal contained in (*b*) should be carried into effect, with the addition that the user also should be empowered to apply to the court. (Recommendation 35.)

ASSISTANCE FOR EXPERIMENTAL WORK.

It appears to us to be very desirable that public funds should be made available to encourage the design and construction of mechanically-propelled vehicles calculated to cause less damage to the roads than some of the types at present in use. Facilities should also be given, by special licence or otherwise, to enable trials and demonstrations to be held of self-propelled vehicles which cannot be used on the roads without breach of the law. (Recommendation 36.)

Among suggestions which do not, the Committee consider, necessitate any change in the present law or regulations, was one that the haulage by traction engines of exceptionally heavy loads should take place at night or at times arranged with the highway or tramway authorities.

The existing law is contained in a number of Acts of Parliament passed at different times and in different circumstances, and the Committee are of opinion that the law should be simplified and that the various enactments should be re-enacted with the necessary amendments in a consolidated form.

The Committee consider that the law in force in England and Scotland should, as far as possible, be assimilated. Their recommendations with regard to such matters as the control of motor omnibus traffic and the regulation of through heavy motor traffic, and with regard to questions affecting bridges, apply to Scotland.

OMNIBUSES FOR LIVERPOOL.

The Associated Equipment Company, Limited, have acquire the contract for Liverpool Corporation's fleet of single-deck omnibuses. This firm, who are sole builders to the London General Omnibus Company, Limited, with their expert knowledge of omnibus and commercial lorry construction, should feel assured of brisk business in the future. Many other Corporations are negotiating with them for omnibuses and chars-a-banc.

GOVERNMENT'S MOTOR DEPOT.

STATEMENT IN DEFENCE OF ITS NEW PURPOSE.

The advocates of the huge motor depot scheme which is being constructed by the War Office at Cippenham, near Slough, have generally been disinclined apparently to make a defence of either the old or the new purpose to which this huge expenditure is to be put. Some time ago, however, a "special correspondent" of the *Daily Chronicle* published a statement which is of considerable interest, although its author makes no reply to the criticism of the project contained in the reports of the Select Committee on National Expenditure published in our issue of December 19. Nor does the writer give an explanation of the committee's revelation that the estimated expenditure has increased from a sum slightly exceeding £1,000,000 to £1,750,000.

Our contemporary's correspondent is also silent concerning the following important points :—(1) The apparent subterfuge of the War Office statement in the House of Commons that the erection of the depot was rendered necessary owing to the Germans having possession of several large depots in the territory which they overran in March last ; (2) the offer of motor firms to undertake the repair of a large number of vehicles at a quarter of the cost of the Government scheme ; (3) the suggestion of the Select Committee that in view of the early termination of the war the Ministry of Munitions should release some of their premises for the storage and repair of vehicles.

The writer does not increase our admiration of War Office or mechanical transport administration by taking the reader to the top of the grand stand at Kempton Park Racecourse to view "the long lines of motor lorries standing up to the axle in mud, and stretching far away to the horizon ; " machines "for which you have paid something like £800 each." Then there are "interminable lines of rusty motor bicycles almost buried in weeds, masses of sidecars, great steam tractors, pathetic little cars, Red Cross ambulances, and always and everywhere you are moving in the midst of lorries."

GROWTH OF ARMY MOTOR TRANSPORT.

The article proceeds :—" For the most part they are unwounded to the eye and are dying only of exposure to the weather. Now before you grow angry with the Government for this monstrous neglect of your property, consider these facts :—

" We started the war with 40 lorries ; we possess now something like 50,000.

" The total number of our vehicles in motor transport was 80 ; it is now about 170,000.

" The staff was 14 ; it is now 2,341.

" The number of vouchers issued in 1914 was about 200 ; during the last six months this number was 127,000.

" The area occupied was 3,500 square ft. ; it is now 650,000 square ft.

" Every six weeks we ' turn over ' 200,000 tires.

" So vastly has this department grown that at one time there were eight miles of London streets occupied by its vehicles, for which no housing could be found. The young officers who built up this department have grown old and grey in the four years ; they have lived, some of them, on the edge of nervous collapse, and yet have worked from dawn to midnight, wrestling with difficulties enough to kill any ten men.

LACK OF 'SCIENTIFIC CO-ORDINATION.'

" The whole thing has been done from hand to mouth. You go into a backyard in Holborn, and see great crates of spare parts standing under roofs which are labelled Salonica, Basra, Palestine. You go into the banquet hall of a city restaurant and find it filled with clerks typing vouchers and documents that will go to the ends of the earth. You go into a brewery and you are shown 29,000 magnetos at £10 each in a cellar, a safe which contains platinum worth £12,000, and a room of spare parts and tools, the whole stock of which is worth a quarter of a million.

" The brilliant men who have so triumphantly organised the motor transport of the British Armies have never been under one roof, have never been provided with any help in the shape of scientific co-ordination. They have had to do the best they can with any old building, and with their various departments scattered all over London, and with no place for the stabling of their vehicles."

HOW TO AVERT A LOSS AT SLOUGH.

An excellent suggestion has been made by Mr. C. W. Brett, managing director and general manager of Barimar, Limited, for converting the Slough site to a more useful purpose. After observing that it is time Mr. Lloyd George " looked into the Slough adventure," Mr. Brett states :—

" Of the 12,000 to 14,000 British engineering shops now existing there are at least 5,000 to 6,000 adequately equipped for work such as is contemplated at Slough, and as, moreover, these are ready to

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proceed now they could probably complete all the repair work at present required long before the Slough depot is in actual operation. This procedure would have the double advantage of finding work and wages for engineers who have handsomely contributed towards the successful results of the war, and cut out a wasteful scheme which the termination of the war renders quite unnecessary. Moreover, definite action, if taken now, will entail no loss. The Slough site would afford the Premier an opportunity to begin at once the great housing scheme he has outlined. Situate within a few minutes' ride of the Metropolis the position is ideal in character for a garden city, and not a penny of the money so far spent need be wasted."

L.C.C. AND MOTOR OMNIBUSES.

SERVICES TO PRECEDE TRAMWAY CONSTRUCTION AND TO LINK UP DEAD ENDS.

The Highways Committee of the London County Council will submit the following report at a meeting of the Council to be held on February 18 :—

London County Council Tramways Auxiliary Omnibus Services.

(1) We are advised that facilities will be afforded for the introduction at a later date than usual of Private Bills in the session of Parliament of 1919.

Owing to war conditions, tramway development has been in abeyance for more than four years ; and it will be useful therefore to recall the fact that before the commencement of the war we decided to depart from the previous practice of presenting an annual list of detached proposals for tramway development. Our list of proposals considered by the Council on November 10, 1914, formed part of a comprehensive scheme for tramway consolidation. Only one of these proposals could be submitted to Parliament, as the Council decided, on the date referred to, not to proceed during the session of 1915 with any schemes to which consent of the road authorities concerned could not be obtained. We shall shortly submit to the Council certain of the proposals of greatest urgency with a view to powers being sought in the session of 1919.

It is anticipated that there may be some delay in carrying out the scheme for tramways consolidation, owing to financial and economic considerations and the uncertainty inseparable from proposals requiring the consent of road authorities in London.

With due regard therefore to the limitations which must be expected on tramway development and extension, and the urgent need for greater facilities for passengers on the tramways systems, we have given careful consideration to the question whether the Council should seek Parliamentary power to run auxiliary omnibus services in connection with the tramways undertaking ; and we are of opinion that such a power should be sought for specific purposes, e.g., linking up tramways dead ends, including necessary overlaps to traffic points, and providing auxiliary services in connection with housing schemes and proposals for tramway extension.

It is the exception, and not the rule, for a large tramway undertaking to be without the means of utilising omnibuses for auxiliary and experimental purposes, as the larger municipal tramway authorities in the country have powers to run omnibuses, and are thus in a position to utilise them fully in connection with tramways. We are advised that the experience of these authorities confirms our view as to the utility of omnibuses for auxiliary and experimental purposes in connection with tramways.

The Select Committee on Motor Traffic appointed to inquire into the circumstances which had led to the large and increasing number of fatal accidents in the metropolis due to motor omnibuses and other forms of power-driven vehicles, and to make recommendations as to the measures to be taken to secure greater safety in the streets, reported (1913) :—

> "A proposal that the London County Council should have power to run omnibuses in order to link up its tramways was mentioned by several witnesses, but was not put forward on behalf of that body. The scheme would require Parliamentary sanction, and your committee are of opinion that, if applied for, permission should be granted. The number of municipalities with such powers has increased, and several years ago included Glasgow, Bristol, Manchester, Leeds, Nottingham, Wolverhampton, Willesden, and other towns. When mentioned to one of the police witnesses, the suggestion was acquiesced in as a very good plan.

POST-WAR COST OF TRAMWAY CONSTRUCTION.

The successful operation of the London County Council Tramways will be prejudiced unless the Council is able, by means of the omnibus, to make a start with traffic services which, but for the war, might have been made by tramway extension. For example, there has already been considerable delay in the linking up of dead ends by means of tramways extension, and the war has been responsible for a new financial consideration, viz., the increased cost of tramway construction. The provision and working of omnibuses by the tramway authority is the practical way of meeting the requirements of the public with the least possible delay.

The provision of omnibuses on trial routes is also a necessity for the Council's tramways undertaking in connection with districts which are being newly developed. Until the development of such districts reaches the stage at which tramway facilities would be practicable, omnibuses could be utilised for the purpose of connecting the districts with the tramway system, with the advantages, in some cases, of allowing the ultimate tramway route to be determined, where there is a choice, as a result of omnibus experiment. For the preliminary route to be determined, where there is a choice as a result of omnibus services auxiliary to the tramways system, should be of great public utility in the early stages of development of suburban areas for housing purposes ; and unless adequate services can be provided by the Council, pending the construction of tramways, the work of the Council in pursuance of its housing policy may be seriously affected.

Although during the period of the war every possible step has been taken in connection with the tramways undertaking to keep down working costs and to reap the fullest advantage obtainable from efficient management, it has nevertheless been necessary to place on passengers a heavier financial burden. There is no immediate prospect of any considerable relief from the extra burden placed on the travelling public during the prevalence of war conditions, and it would be inequitable therefore to throw directly on the undertaking, and indirectly on the travelling public, the additional financial burden which would result from tramway construction of a temporarily unremunerative character.

SERVICES TO TRAFFIC POINTS AND BUILDING AREAS.

We consider that it would be undesirable for the operation of omnibuses by the Council to be limited strictly to the area of the County of London, as the traffic problems of Greater London call for treatment on a less rigid principle than that determining, under existing legislation, the sphere of operations of particular tramway authorities. On the other hand, we do not propose that the power to run omnibuses outside the county should extend beyond the reasonable requirements of the public using the Council's tramways undertaking. We think therefore that the Council should be empowered to operate omnibuses beyond the boundary of the County of London to traffic points and to newly developing districts and housing areas.

The solicitor has reported to us, in accordance with standing order No. 175 (4), that the Council has power to promote this legislation, and he advises that the Council should proceed under the provisions of the Borough Funds Act, 1872, as applied by the County Councils (Bills in Parliament) Act, 1903. Ten clear days' notice will therefore have to be given by public advertisement that the question of promoting legislation will be considered by the Council at a meeting to be held on a specified date, which we suggest should be February 18, 1919. It will then be necessary for the Council, should it desire to proceed with the proposal, to pass a resolution to promote the legislation and to defray the costs of so doing out of the county fund. Such resolution must be passed by an absolute majority of the whole number of the Council, and subsequently the Council will have to pass confirming resolutions and will also have to obtain the approval of the Local Government Board to the course of action proposed to be taken.

We have communicated particulars of our proposal to the Finance Committee and the Parliamentary Committee, whose reports will, we understand, probably be submitted to the Council on February 18, 1919. We recommend :—

(a) That the operation of Standing Order No. 192 be suspended in order that the following recommendations (b) may be dealt with.

(b) That notice be given by public advertisement of the intention of the Council to consider at its meeting on February 18, 1919, a proposal that it shall take the necessary measures for promoting in the session of Parliament of 1919 legislations to enable the Council to own omnibuses, and to run, in and in the vicinity of the County of London, auxiliary omnibuses services, for the linking up of tramway dead ends and for other specific purposes ; and to defray out of the county fund the cost and expenses of so doing.

G. H. HUME, Chairman.

The report of the Finance Committee under standing orders was to the following effect :—" The Finance Committee have not yet received sufficient particulars to enable them to report upon the financial bearings of the proposal, but they hope to be in a position to report when the matter is considered on February 18."

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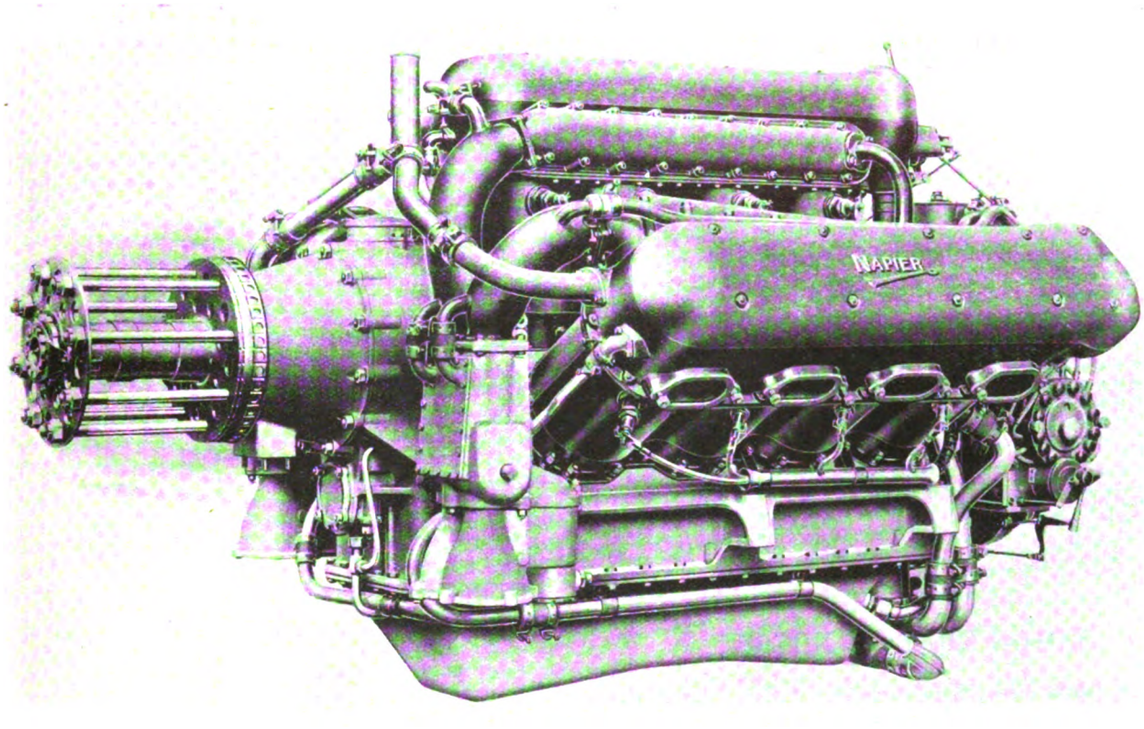
450-H.P. NAPIER "LION" AERO ENGINE.

With the conclusion of peace in sight, British motor engine manufacturers are permitted to reveal something of their productions for the aerial service. A work of great interest is the 450-H.P. Napier "Lion" aero engine made by Messrs. D. Napier and Son, Limited, and shown in the appended illustration.

The general arrangement of the engine is easily seen from the photograph, but the latter does not give an accurate idea of the small size of the actual engine, a factor which assists very materially the aeroplane builder in designing his structures with minimum head resistance. The engine is light, the weight coming out at 1·85 lb. per B.H.P. at normal power. The petrol consumption and oil consumption figures are very good. The engine although so light in weight maintains the Napier reputation for reliability in an extremely satisfactory manner. The Napier tradition of performance is well carried on, a machine fitted with one of these engines having broken records for performance.



Napier 450-H.P. 12-Cylinder Aero Engine.

There are 12 cylinders, 5½ in. bore, arranged in three blocks. The crank shaft is a 4-throw shaft carried on roller bearings, and three pistons are connected with each crankpin. There is a master rod for the centre block and links for the two side ones. Due to the general principle of the design adopted, the engine, although light in weight, is extremely stiff due to its compactness, and runs extremely sweetly. The reliability of the engine follows partly from the smoothness of running, and largely due to the design permitting individual parts being made quite robust, with a very low total weight of the engine.

A reduction gear is fitted and this runs very sweetly, owing to the stiffness of the crank shaft. The gearing is arranged with the air-screw shaft over the crank shaft to permit the largest possible diameter propellor being fitted, so that the greatest possible efficiency can be obtained, and the power of the engine fully utilised. In fact, the engine has been built with a view to suit the special conditions of aeroplane work, bearing in mind that in this particular branch of engineering efficiency pays to an even greater extent than in any other form of handiwork. The cylinders are made from steel forgings and have steel jackets. The head is of aluminium and carries the camshafts which act directly on the valve heads. There are four valves to each cylinder, two inlets and two exhausts. The carburettors are arranged low down at one end of the engine, with separate air intake pipes, this arrangement being adopted to prevent any possibility of the machine catching fire due to engine trouble. There being three separate intakes prevents any possibility of a back-fire in one cylinder stopping the whole engine, as in such case, if one block back-fires, the other two blocks will keep ths engine running and suck in the flames. More attention has been paid to the heating of the carburettors than is usually the case, and water jackets are carried right down and round the throttle barrels themselves to prevent them freezing at high altitude. This is very necessary, as a temperature as low as 35 deg. Cent. was recorded during the test of one of these engines. All moving parts are so completely enclosed that it is difficult to tell by looking at the engine whether it is running. The usual accessories are fitted, and provision is made for starting, speedometer drive, etc. Lubrication is entirely automatic, and very complete arrangements are made to prevent over-lubrication when the machine to which the engine is fitted is dived or climbed steeply for a long time, a point perhaps more important on a fighting machine than in a commercial aeroplane.

DISPOSAL OF ARMY MOTORS.

Major-General Sir C. R. Crofton Atkins has been appointed to the new Ministry of Supply, and during the last week in January was busy in the task of organising a motor sales department, through which surplus Government motor vehicles are to be disposed of. The new chief was formerly director of transport and supply at the War Office. His first task in his new appointment was to co-ordinate the departments at the War Office, Surplus Government Property Disposal Board, and Mechanical Transport Directorate, which have been dealing with the inspection and sale.

The suggestion has been made that the surplus and disabled motor vehicles should be disposed of by a committee of Government and trade representatives, and that spare parts should be sold to the makers and not in competition with them.

Sir James Stevenson, chairman of the Co-ordination Committee dealing with the demobilisation of munitions, has stated that the Government will have something like £30,000,000 worth of motor vehicles to sell, and that the commercial ones alone represent about three years' pre-war output of the British factories. Sir James has insisted upon the need for the Government carrying the trade with it in the steps taken to dispose of the machines.

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MOTOR VEHICLES FOR MUNICIPALITIES.

HEYWOOD COUNCIL propose to borrow £3,000 for the purchase of a motor fire engine, etc.

STRETFORD URBAN COUNCIL are considering the desirability of purchasing additional motor wagons.

ABERDEEN CORPORATION are purchasing two 4-ton Leyland motors for the street cleansing department.

LEEDS CITY COUNCIL have ordered a 3-ton steam wagon from the Yorkshire Commercial Motor Company, at £1,025.

BOLTON CORPORATION have purchased steam wagons for haulage work in connection with the construction of a reservoir.

BATH SURVEYING COMMITTEE have asked the surveyor to report on the subject of street watering by means of mechanical power.

MANCHESTER CITY COUNCIL have placed an order with Messrs. Drake & Gorham, Limited, for a 3½-ton electric tipping wagon.

EASTBOURNE CORPORATION have received amended prices and specifications from Leyland Motors, Ltd., for the supply of a number of new omnibuses.

HALIFAX COUNCIL have accepted the Electrical Chloride Storage Company's tender for supplying new batteries for an electric vehicle for the sum of £249.

DERBYSHIRE COUNTY COUNCIL have been recommended by their Highways Committee to purchase additional motor wagons, etc., at an estimated cost of £10,000.

LOWESTOFT COUNCIL have received the sanction of the Local Government Board to borrow £1,136 for the purchase of a steam wagon. The loan will be repayable over a period of ten years.

CALCUTTA MUNICIPAL COUNCIL have appointed a sub-committee for the purpose of determining the most suitable method of refuse collection by means of motor wagons, and what types of vehicle should be purchased. There is a total of 1,200 tons of refuse to be moved per day.

HASLINGDEN TRAMWAYS COMMITTEE have appointed a sub-committee to make inquiries as to the cost of petrol-driven and electrically-propelled road vehicles, with a view to complying with the request of residents in Helmshore to be provided with means of communication with Haslingden.

GILLINGHAM COUNCIL have been informed by Edison Accumulators, Limited, that they are prepared to accept payment for battery dust lorries by instalments, with interest at 1 per cent. above bank rate on unpaid balances. Charging plant has been purchased from the General Electric Company at a cost of £409.

MOTOR TRAFFIC NOTES.

OMNIBUSES FOR STRETFORD.—Stretford Urban Council have decided to seek Parliamentary power to enable them to provide and run motor omnibuses.

REPAIRERS OF COMMER CARS.—Commercial Cars, Limited, Luton, have appointed Commercial Car Hirers, Limited, of 112a, Junction Road, Holloway, N., as official repairers of Commer cars.

MUNICIPAL OMNIBUSES FOR EAST HAM.—The Corporation have decided that the tramways engineer and manager should obtain estimates for the supply of twelve motor omnibuses for submission at a subsequent meeting.

NEW MANUFACTURING FIRM.—The Graham-White Company, Limited, aeroplane manufacturers, are devoting part of their works to the construction of bodies for motor lorries and vans, and the repair of industrial motor vehicles.

DEMAND FOR BRITISH MOTORS IN EUROPE.—There is a great demand for British military motor vehicles in continental countries which are faced by the reconstruction problem. Only a limited number is likely to be available until after the military occupation of Germany has ceased.

L.G.O.C. ABSORBS THE ASSOCIATED OMNIBUS COMPANY.—The shareholders have confirmed the resolutions passed at a meeting held on December 31 last approving the sale of this undertaking to the London General Omnibus Company, and the voluntary liquidation of the Associated Company.

MEMORANDUM ON SLIPPERY ROAD SURFACES.—In a memorandum presented to the London Safety First Council the relative liability of vehicles to slip on various road surfaces is placed as follows:—(1) Natural rock asphalt, (2) tar bound macadam, (3) water-bound macadam, (4) wood pavement, (5) granite sets.

U.S.A. EXPORTS OF MOTOR VEHICLES.—In October last the United States exported 737 industrial motor vehicles, as against 1,359 in the corresponding month of 1917. The countries to which the vehicles were consigned were France (392), Canada (115), Great Britain (42), Cuba (41), Russia (15), and other countries (132).

BOURNEMOUTH CHARS-A-BANC.—The Hackney Carriage Committee of the Bournemouth Corporation have come to the conclusion that the licences for vehicles going outside the borough, and not intended for local traffic in Bournemouth, should be limited to fifty. Licences are being granted to local firms in respect of 43 vehicles.

GREAT WEST ROAD OUT OF LONDON.—Mr. W. T. Wakelam, county engineer, has been instructed by the Middlesex County Council to proceed with the preparation of the plans, specifications, and quantities for the construction of the Great West Road immediately circumstances permit, with a view to the work being carried out by contract.

MOTOR EXHIBITION AND ISLE OF MAN ROAD RACE.—For the first time since 1913 the Society of Motor Manufacturers and Traders have arranged for the holding of an exhibition of private cars at Olympia. It will take place in November next. The Royal A.C. hope to arrange for a road race in the Isle of Man in June or July. The renewal of the road trials will not be witnessed until next year.

FORTY-HOUR WEEK AT THE FORD MOTOR WORKS.—Sir Percival Perry, managing director of the Ford Motor Company (England), Limited, Trafford Park, was presented recently by the employees with an address of congratulation on his knighthood. In reply, he announced a reduction of working hours from 48 a week to 40, and such an alteration of minimum rates as to effect a rise in wages as from January 1.

SCOTTISH MOTOR TRACTION COMPANY.—For the year ended September 30 last this company, which runs omnibus services in the Edinburgh district, announces a dividend on ordinary shares of 7½ per cent., free of tax, for the seventh consecutive year. The available balance was £10,535, after placing £4,000 to reserve (making a total of £22,000). The sum of £3,141 was carried forward, as against £3,308 for the year 1916-17.

MOTORS TO LINK UP TRAMWAYS.—Mr. Arthur Ellis, electrical engineer and tramways manager of Cardiff Corporation, has submitted a report as to tramway extensions and means of transport between the city and the adjoining districts, and the matter is to be brought before the Parliamentary Committee. Mr. Ellis in his report points out that the object in view is the development of the outside districts, probably by motor omnibuses, in order to feed the tramway system.

THE FRENCH WAR IMPORT TAX ON MOTORS.—Mr. Claude Johnson, managing director of Rolls Royce, Limited, is hopeful that in accordance with the French law of May, 1916, the 70 per cent. *ad valorem* tax on all motors imported into France will be rescinded on the signing of peace. Many French constructors, however, are asking for the protection of the tax for at least two years, while others regard eight months as the minimum time in which they can reorganise their factories on a peace basis.

ESSEX OMNIBUS TRAFFIC.—The Highways Committee of Essex County Council recommend granting the application of Mr. C. A. Parker, carrier, of Manningtree, for permission to run a motor omnibus from Manningtree to Colchester, and Manningtree to Ipswich, on the following conditions:—The payment of £1 per annum for the route, payable in advance on January 1 each year, and a contribution of one farthing a mile per omnibus. The rate is subject to revision 12 months hence.

NATIONAL STEAM CAR COMPANY MAY RUN PETROL OMNIBUSES.—Reporting at the annual meeting of the company that as the result of negotiations the directors had made an agreement with the London General Omnibus Company, Mr. Hawksley, the chairman, said it placed the Steam Car Company in a very favourable position as regarded rolling stock and running expenses, and it could, if desirable, obtain and run the identical vehicle in use by the London General Omnibus Company. If the board found that petrol omnibuses were the most profitable in London, they would adopt them.

A TRAMWAY MANAGER ON OMNIBUS TRAFFIC.—In taking leave of Chesterfield Corporation, before his departure for London to manage a motor transport undertaking, Mr. Acland, the tramways manager and electrical engineer, remarked that the motor omnibuses belonging to the Corporation had been self-supporting, but the road problem was a very pressing one. He was convinced that roads could be made at a reasonable cost to withstand any motor traffic, and then their omnibuses would show a better return. At present the motors damaged the roads and the roads knocked the motors to pieces.

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THE Tramway & Railway World
WITH MOTOR TRAFFIC SECTION

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NATIONALISATION OF TRANSPORT AND ELECTRICITY SUPPLY.

A TITANIC SCHEME FOR THE UNIFICATION AND CHEAPENING OF COMMUNICATION.

The possibilities which underlie the Government's Bill for the establishment of a Ministry of Ways and Communications (which was ntroduced in the House of Commons on February 26, and the full text of which appears in this issue), can only be described as immense. At first glance the generality, not to say vagueness, of the text might lead one to suppose that there was not such a very great deal in it as the promises of the Government led the public to expect. The word "nationalisation" does not figure in the measure at all. But as the reader studies the text carefully, the more he knows about the present and past of means of transportation in this country and of the laws governing it, the more he will realise that this apparently simple Bill is a proposal for a legislative revolution. In its ultimate effect the scheme is likely to be as far-reaching as any single proposal ever submitted to Parliament. The aim in view—namely, enormously to improve and cheapen transport facilities and electricity supply—commands general approval. In regard to methods and details there will be considerable difference of opinion. The almost incalculable possibilities involved will doubtless be fully brought out in the detailed examination which the Bill is receiving both inside and outside of Parliament. Meanwhile, it may be said generally that it is an "enabling" Bill, and the things which it enables the Minister of Ways and Communications to do suggest the adjectives, so often misapplied but here truly descriptive, of Herculean or Titanic to describe the labours which lie in front of Sir Eric Geddes.

The Minister, in the first place, has imposed on him the duty of improving means of locomotion and transport, and there is to be transferred to him all powers and duties of any Government department in relation to railways, light railways, tramways, canals, roads, bridges and ferries, and vehicles and traffic thereon, harbours, docks, and piers, and the supply of electricity. With a view to affording time for the formulation of future policy, the Minister will for two years control railways, tramways, and other means of locomotion. After that, the remaining provisions of the Bill are enabling. The King may by Order in Council authorise the Minister to purchase and work railways, tramways, etc., to establish and work similar undertakings, and to lease them. Price, failing agreement, is to be fixed by arbitration. Any such Order in Council must lie on the table of Parliament for 30 days, and if either House presents within that period an address to the King against it, no further proceedings shall be taken on it. The Minister may make advances to authorities or companies for construction, improvement, or maintenance of means of transport. That is the whole substance of the Bill, and yet it is enough.

It may be observed that there are no authoritative recommendations, of recent date at least, from any Government Commission or Committee in favour of railway nationalisation, nor in the case of tramways has the subject ever been mooted. Here, however, is where the "enabling" nature of the Bill comes in. Orders in Council may be made for such purposes, but there is to be a period of two years from the passing of the Bill during which the Minister may take possession of railways, canals, tramways, and harbours, and during which he is to consider and formulate a policy for the future position of the undertakings. Various investigations can take place during that period, but a time limit is put upon them.

The Minister may for the two years take over the possession and control of the railways now exercised by the Government and also of other railways, and of light railways, tramways, canals, and harbours. The directors, officers, and servants of any undertaking so controlled are to obey the directions of the Minister as to the user thereof in regard to many specified matters which taken together give complete control. The Minister may by Order authorise the owners to acquire land and construct works. Another remarkable feature is that any rates, fares, etc., directed by the Minister shall be deemed to be reasonable notwithstanding any statutory provisions.

THE ORDERS IN COUNCIL.

There may be much criticism of the proposal that the purchase of railways, etc., by the Minister can be authorised by Orders in Council. The question of the advisability of any particular purchase is thus removed from the direct control of Parliament, except that the latter can by resolution annul an Order during the 30 days when it is lying on the table. Experience shows, however, that it is a very rare thing for such an annulment to be brought about, as the Government of the day naturally support the Order. Moreover, such discussions in the House of Commons usually come on late at night after ordinary business is disposed of. They are accordingly perfunctory, and they take place at such an hour that they cannot be reported in the morning newspapers, so that there is little publicity. The opposition to this arrangement may be one of the dangerous rocks in the path of the Bill.

As to the cost of purchase, the Treasury may issue securities to meet it. The financial aspects of this transaction form another topic for serious discussion. When an undertaking is acquired or established, the Minister, unless he leases it, is to operate it in the national interest, and is to be entitled to fix such rates, fares, etc., as he thinks fit, notwithstanding any statutory limit. What would existing railway or

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tramway authorities think if they were given such powers? Quite evidently the Government have in view the future demands of labour, and the general public are to pay.

The possibility of the continuance in the hands of companies or municipalities of undertakings is not barred, and hence interest attaches to the power of the Minister to make advances to authorities or companies for construction, improvement, or maintenance.

Municipal Tramways.

A notable variation in the power to purchase tramways is made in the case of tramways owned by local authorities. The Order in Council shall not authorise the Minister to purchase these except by agreement, nor to purchase without the consent of the local authority any tramway which a local authority, under Section 43 of the Tramways Act, 1870, are entitled to purchase. While there seems good reason to believe that under the Bill a nationalised system of railways, harbours, docks, and canals is possible, it does not appear that such a result is so likely in the case of tramways unless the local authorities change their attitude. The ownership and operation of tramways has come to be regarded as such an essential part of the functions of municipalities that it hardly seems likely they will consent to State ownership and operation. In any case, the advantages which would arise from a nationalised tramway system would, for some time at least, be less remarkable than those expected to come from unified control and operation of the railways, which by junctions form one big system.

Events may, however, so shape themselves that the municipalities will see the wisdom of coming into line. There might then be unified control and operation of large tramway systems, each of which is at present owned by several authorities. Advantages both as to efficiency and economy would be secured, for example, if all the tramways in the metropolitan area, or in South Lancashire and West Yorkshire, were under unified control. Further, the Minister is given powers which will facilitate extensions, and the linking together of adjacent undertakings. Great developments in this way should be possible under the Bill, but it is quite certain they will take time. It will be when questions of policy, initiation of schemes, and the selection of the best with an eye to the general benefit arise that difficulties will begin. It wi l be then also that enterprise, wise judgment, foresight, knowledge of traffic conditions, and power to reconcile conflicting local prejudices will have the opportunity of showing their qualities. There is no specific provision in the Bill for the repeal of the restrictive provisions of the Tramways Act, 1870, as to the veto of local authorities, etc., but apparently that is what is contemplated.

The municipal tramways opposition to the Bill may be bought off by the exception above referred to, but on the other hand unification of tramway control in given areas may be delayed.

Roads.

The Bill of course does not propose that the Minister should buy roads, doubtless because no one has a monopoly of the use of a public road, nor is there a charge for using it. But existing powers of Government departments in regard to roads are to be transferred to the Minister. This applies also in the case of bridges and ferries, and vehicles and traffic thereon. Advances may be made for construction and maintenance.

The most determined opposition has been threatened by the automobile interests to the proposal to give to the Minister such powers over roads and traffic upon them. They contend that there should be a separate Minister for roads, that railway interests are antagonistic to road interests, and that under the Bill the road users will suffer. When one remembers the hostile, not to say bellicose, attitude through the years of its existence of the automobile world towards railways and tramways, such a position is not surprising. The road motor business, whether for the carriage of passengers or goods, is in a highly privileged position as regards permanent way, and it is no doubt the fear that that position will be placed on a more equitable basis which lies at the bottom of the hostility. Should motor vehicle owners, however, get their way, there would be a serious breach in that co-ordination of all forms of transport which the country has a right to expect, and, indeed must have. Motor traffic ought to be brought into the scheme, and be regulated in relation to all other kinds of traffic, just as those other kinds are to be regulated as between themselves.

Sir Eric Geddes,
Minister of Ways and Communications.

Electricity Supply.

Perhaps the most novel part of the Bill is that relating to electricity supply. During last year we had the reports of the Coal Conservation Committee of the Ministry of Reconstruction, the Board of Trade Electric Power Supply Committee, and other official bodies in favour of the establishment of a great national electric power supply, with the object of providing a cheap and abundant supply of power for all purposes all over the country. At the general election in the end of the year Ministers spoke strongly in favour of such a development. In introducing the Ways and Communications Bill on February 26, the Home Secretary (Mr. Shortt) said that the measure provided for taking over the control of the supply of electricity. He justified this control being in the hands of the Minister of Ways and

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Communications as transport is the greatest and most permanent customer for electricity, and just as the increase of the use of electric power by manufacturers would raise output, so would the traffic on the railways increase. He might also have pointed out that extensive railway electrification is hoped for under the Bill.

When one comes, however, to examine the Bill, very little is to be found on the subject. The first statement on the point is that the supply of electricity is one of the matters in regard to which the powers and duties of any Government department are to be transferred to the new Minister. The power of control for two years of railways, tramways, etc., does not include electricity supply. Neither does the power to purchase undertakings specify electrical undertakings, nor are they mentioned in the list of subjects towards the development of which the Minister may make advances. In fact, the only other reference to electricity in the Bill is contained in Clause 6, which provides that it shall be the duty of the owners of any railway, tramway, canal, inland navigation, dock, harbour, pier, or electricity undertaking, and the authority liable to maintain any road or bridge, to furnish to the Minister such accounts, statistics, and returns as he may require.

The solution of the matter lies in the fact that the Board of Trade are preparing a Bill to deal with electric power supply. This measure will be based on the recommendations of the committees referred to above, and it is understood that when the necessary executive and administrative bodies have been constituted the general control will be placed under the Minister of Ways and Communications.

SIR ERIC GEDDES.

Sir Eric Geddes, who is to be the first Minister of Ways and Communications, has had a varied and important career. He is only 43 years of age, having been born of Scottish parentage in India in 1876. Entering railway service, he rapidly rose to important positions. The Rohilkund and Kumaon Railway and the Baltimore and Ohio Railway gave him positions which were stepping-stones to his appointment as deputy general manager of the North Eastern Railway. When the war had been going on for a year or two Mr. Lloyd George began a wise policy of selecting for important posts in the Government, and also in administrative work, men of outstanding ability in various walks of life. The need for railway development and communication behind the British lines in France became very urgent, while at the same time the strain on the railway system at home was specially severe. So it came about that in 1916 Sir Eric Geddes was appointed Director-General of Military Railways and Inspector-General of Transportation. Doubtless it was because of the faculty which he showed as an organiser that in the following year he was appointed First Lord of the Admiralty, a position which he held till the end of the war. Sir Eric being the holder of one of the most important posts in the Government, it became advisable that he should be a Member of Parliament, and a seat was found for him at Cambridge, which he represents in the Unionist interest. In the new Government which came into office after last general election Sir Eric Geddes took the place of a Minister without portfolio, and it was speedily announced that he would be appointed Minister of Ways and Communications as soon as that office was created. It is reported that he has already done much preliminary work in connection with his new office. Having previously relinquished his position on the North Eastern Railway, he is free to devote himself to the great task which lies before him.

RAIL CREEP AND EXPANSION.

By E. Capone.

In undertaking the construction, maintenance, or electrification of railway permanent way one of the problems claiming consideration is the provision that has to be made to prevent as far as possible troubles arising from the creeping of the track rails and to arrange the mechanical side of the work in such a way that the inevitable expansion and contraction may take place without causing an element of danger to traffic. In the case of creeping we have to deal with an unknown quantity as regards to the amount of movement, but the direction in the case of flat-footed track rails is pretty certain; with conductor rails the movement is quite uncertain, as it has been observed both against traffic and up a grade. Track rail creep is to a great extent checked by anchoring and using cross stays, but in the case of conductor rails the creep is checked by concrete anchor blocks connected to the conductor rail through strain insulators (Fig. 1); on short lengths a simpler and less expensive way is adopted (Fig. 2). Both the methods illustrated have been found from practical experience to be reliable and effective.

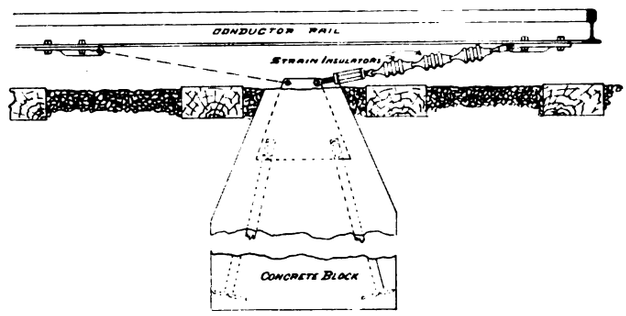

Fig. 1.—Anchor for Conductor Rails up to Half Mile Lengths.

With expansion and contraction we are dealing to some extent with a known factor, and in taking a 32 in. movement in a mile of rail for a variation of 80 deg. Fahr. we have something to work on. In the assembly of lengths of rail shims are applied between each length; to permit of this various thicknesses of shims are used, depending on the temperature at the time of assembly. Expansion must not be restricted and provision should always be made for the concertina action which takes place. Ends and joints must be flexible to absorb this movement, otherwise distortion of the rail will be the result.

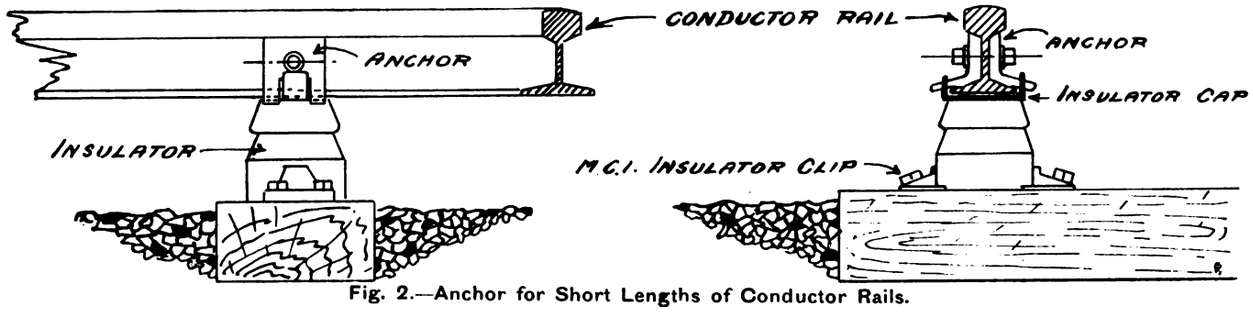

Fig. 2.—Anchor for Short Lengths of Conductor Rails.

It is a difficult matter to separate or exactly define to what extent creeping is due to the constant expansion and contraction which takes place. One point of interest has been observed, namely, that with a rising temperature the tension set up in the rails is released by the vibration of a train passing, and a cracking sound is observed due to the give at joints.

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The elongation produced at the latter is generally ahead of the train. This can easily be accounted for when it is considered that the train acts as an anchor weight on the rails, and the expansion given at the joints tends to thrust the rail forward or away from oncoming trains. An impressive statement as to the extent of rail creeping is made in Mr. Tratman's book, where it is stated that a movement of 42 ft. in one month has been found to take place on the Eads arch bridge over the Mississippi River. The method of dealing with such conditions is here shown diagrammatically in an illustration. The rail cannot be held against such a strain, and is therefore allowed to move; in order to permit this, switches are placed as shown, and the rail lengths as they move past the switches on the left-hand side are taken off and put on the right-hand end, thus allowing a constant movement of the rail (Fig. 3).

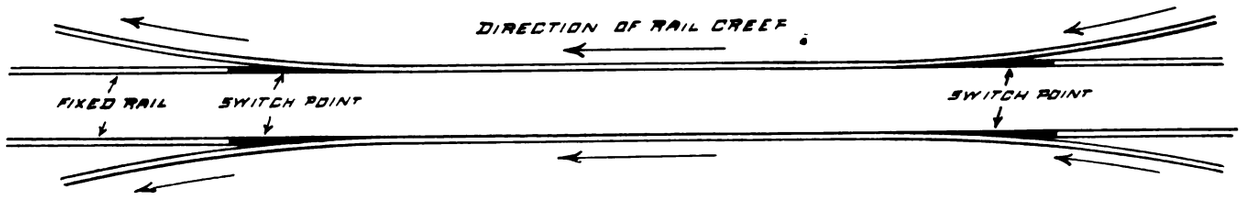

Fig. 3.—Diagrams Showing Arrangement to Allow Creep of Rail.

The three principal factors influencing rail creepage are traffic, climate, and road bed. For certain foreign lines the localities being devoid of stone, the soil is soft, and stone has to be imported, but it naturally follows that such conditions are not comparable with lines put down where suitable soil for the road bed and ballasting is plentiful. A soft or elastic road bed assists creep, since the train can be considered to be travelling in a hollow or depression formed in the track by its own weight. An illustration of a train starting and braking at a station, and a diagrammatic indication of the effect produced on the rail (Figs. 4 and 5), is here given. A train pulls itself along by means of the rails having a tendency to elongate or stretch the rail in front and to thrust or to compress the rail behind. When the train is coming to a standstill, or braking, the reverse action takes place. The exact value of the respective forces cannot be estimated, but the result can be observed, and to show a typical case an illustration is given which has been taken from actual observations of rail movements and distortions of sleepers (Fig. 6). The two inside rails are practically stationary; it is only the outside rails which move in the direction of the traffic. The fact that the inside rails do not move is due to the counteracting forces being in juxtaposition, and also owing to the anchoring effect of special work at crossovers and junctions, etc., for it is only on these inside rails that the cross-tying and fixing of special work is placed, the outside rails are seldom broken in such a way as to be held. On newly laid road beds, where the latter have not been shaken down and are of a more

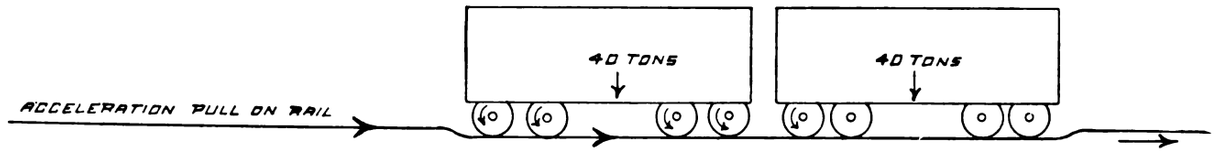

Fig. 4.—Track Deflection and Pull Due to Starting.

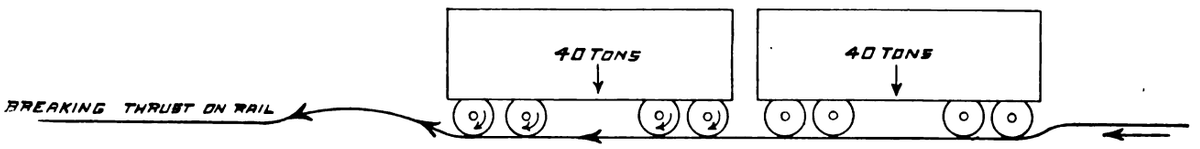

Fig. 5.—Track Deflection and Thrust Due to Braking.

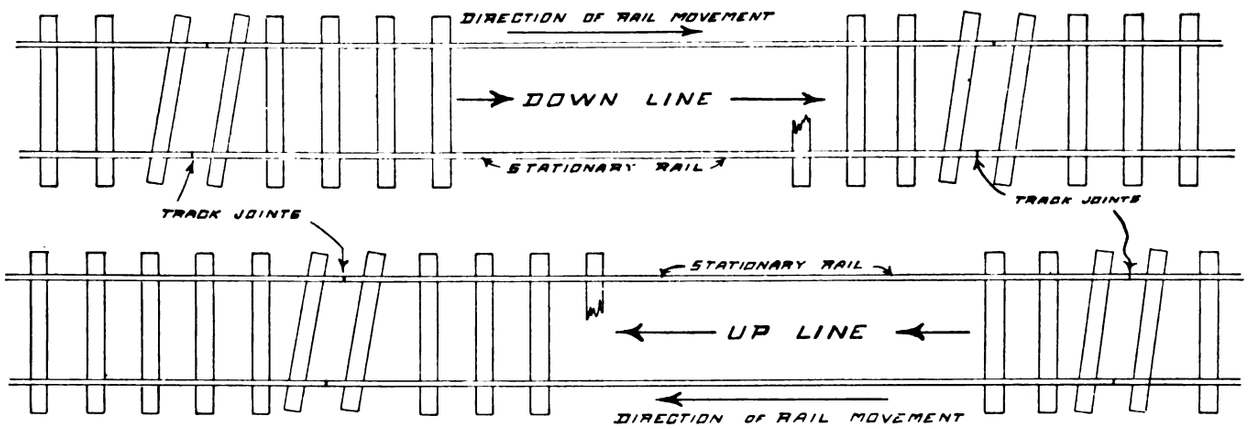

Fig. 6.—Plan of Tracks Showing Rail Movement.

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springy nature, the depression caused by a train is greater, and the wave, as it were, that is produced in front of the train gives a greater creeping effect, but after a time it is observed that with repacking and ballasting the movement of rails is not nearly so noticeable. The creeping, as the illustration shows, is only observable at the joints of the track; this is owing to the fishplates being slotted to take a dog-spike, which is driven into the sleepers on each side of a joint. Each joint therefore acts as an anchor, and the movement of the rail pulls the sleepers along with it, as shown. There are several methods of anchoring sleepers, and one usually adopted is by the use of cross ties of band iron about 2 in. by $\frac{1}{2}$ in. by 10 ft. long, bolted to the sleepers so as to hold the joint sleepers in position; two methods in use are shown on the illustration (Fig. 7), one with the tie-bars placed diagonally and the other with the bar run parallel with the rail and placed on the outside. In the latter case it is bolted to the two joint sleepers, and attached to the three others as an anchor. These methods are especially adapted to the Vignoles type of rail, which rests direct on and is spiked to the sleepers.

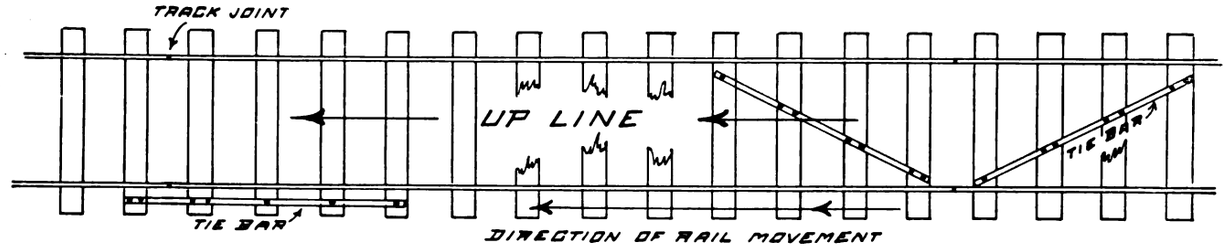

Fig. 7.—Method of Anchoring Sleepers.

It may be of interest in this connection to show the test results taken to ascertain the creeping taking place on a conductor rail. Fig. 8 is a typical diagram, giving a record over about eleven weeks at temperatures varying 28 deg. Fahr. It will be observed, as before mentioned, that no definite movement can be looked for, and it is only by observation that the extent and direction can be ascertained. The diagram shows that the rail in one case moves 10½ in. with the traffic on a down grade, and in the other length of rail it moves 6¾ in. against the traffic on an up grade of 1 in 100. It is on account of this uncertainty that the rail is anchored in the middle of its length to withstand a pull in either direction; only one anchor is used, and the length of rail not allowed to exceed, say, half a mile. Being anchored in the middle, the ends are free to move in and out, and allowance for this expansion is made at the ends of the conductor rail to give clearances for rolling stock. The conductor rail is not subject to the complex conditions prevailing on the track, and one might reasonably look for more definite or reliable movements, but the movements are erratic and difficult to analyse.

The track rails are practically anchored at every sleeper, but the conductor rail rests on insulators, allowing for every flexibility, hence the presence of entirely different features. The pull on a long length of conductor rail has on several lengths gone up to 8 tons, but this is again a very variable quantity. In theory expansion is allowed at each joint, and the bonds are formed for flexibility and certain movement, but in practice to allow for flexibility at joints means that those near the anchor are either in a constant state of tension or under constant compression. The rail always crowds up in one direction, and is held by its weight. The nicety of adjustment at each joint is impossible under the strain always produced by the tendency of the rails to creep along.

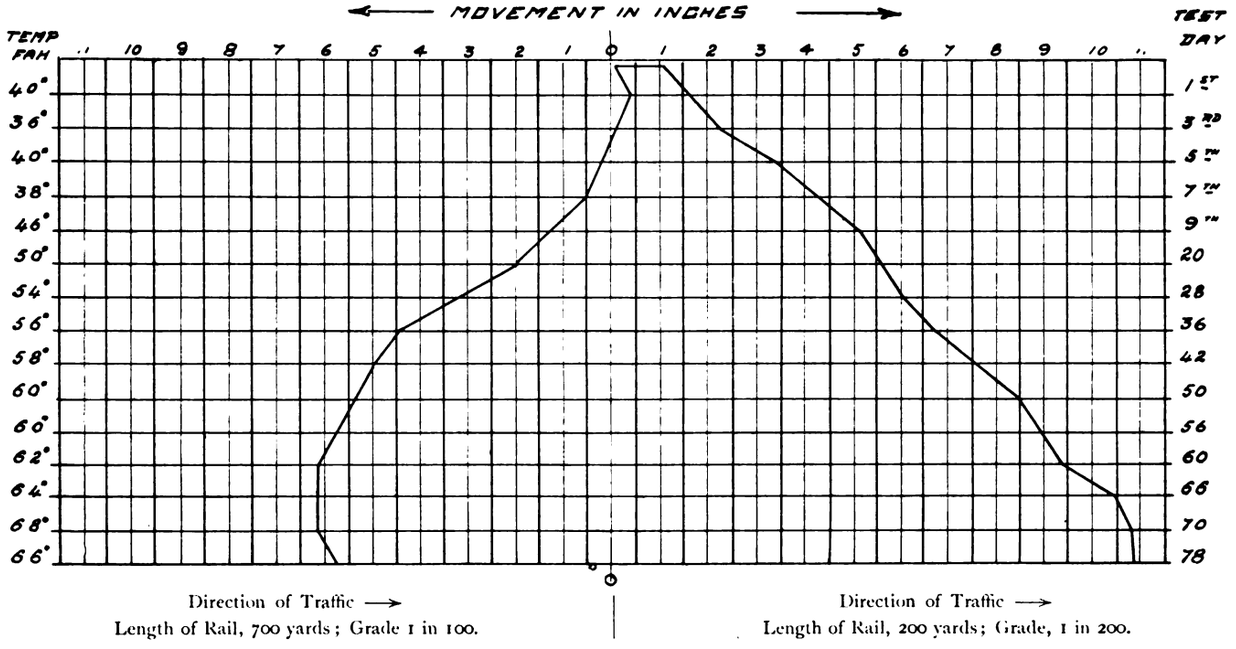

Fig. 8.—Typical Record of Conductor Rail Movement.

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PLIGHT OF CAIRO ELECTRIC CARS AFTER A NILE DELUGE.

EXTRICATED BY BRITISH TROOPS.

The recent deluge in the Cairo district had a deplorable effect on a number of electric railway cars at Cairo which were standing in a depot or siding situated on low lying land outside the city. The rush of the water brought with it an avalanche of sand, with the result that when the flood had receded the cars were embedded in sand to a height in some places of about half way up the side windows. British troops joined in the work of freeing the rolling stock, and they had a by no means light task, for in places the sand was two feet above the height of a man. Two photographs on the following page indicate in a striking manner the condition of the cars just after the deluge had subsided, and show the arduous character of the work of extrication.

Prior to the war the electric cars were a great convenience to visitors to Egypt, but during the past four and a half years this traffic had almost entirely disappeared, for Egypt has been a base for British military expeditions during almost the whole of that period. First there was the Gallipoli campaign, then the defence of the Suez Canal against the attempted invasion of Egypt by Turks and Germans; finally there was the British and Arab advance, which ended in the freeing of Palestine from the Turkish yoke. Several hundred thousand troops from Great Britain and Ireland (drawn from the Old Army, the Territorial Force, including the Yeomanry, the New Army, Australia, and Canada) have stayed for various periods in Egypt, and a large number encamped in the vicinity of Cairo. Many thousands were also treated in hospitals which had to be put up to deal with the wounded. The military visitors brought a record traffic to the railways and tramways. Electric cars traverse the principal thoroughfares of the city, and also run for considerable distances into the country. Nearly all the street tramway routes in Cairo start from or pass through the Esbekiyeh Gardens, where the theatre is situated.

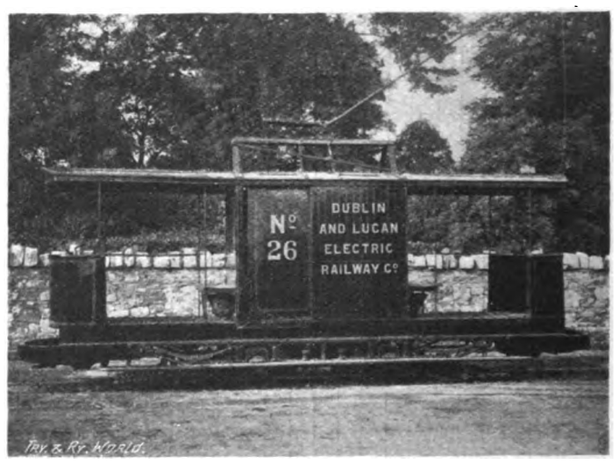
The routes most used by tourists are (1) to the Citadel, (2) to the principal railway station and Abassieh, (3) to Old Cairo, (4) to Boulak, (5) to the Zoological Gardens and the Pyramids, (6) to Heliopolis. For some years the usual way of seeing the Pyramids was to journey by electric car from the Kasr-el-Nil Bridge after an early breakfast, and return to Cairo in time for lunch, but this plan does not give time for more than a climb to the summit of the Pyramid of Cheops, a glance at the Sphinx, and a hasty inspection of the interior of the Great Pyramid. Tourists with more time at their disposal travel by electric cars to the Pyramids, and sleep at the hotel at the foot of the Pyramids. This plan enables them to climb the Great Pyramid in comfort early the next morning, before the rush of tourists from Cairo. The original route to the Pyramids *via* the Kasr-el-Nil was 8·9 miles, but since the construction of the Boulak Bridge it has been considerably shortened, and part of the original route has been abandoned.

The first electric lines were opened for traffic in 1896, and they were afterwards considerably extended, the extension including the route to the Pyramids. The original mileage was 14·26 miles, mostly double track, with a metre gauge. In 1899 there were 36 miles of track, and considerable extensions have since been constructed, together with additions to the generating plant. The power-station is situated near the point where the Ismailia Canal enters the River Nile. The water for the station is taken from the Nile and stored in a reservoir, but before entering the basin it is freed from the large quantities of sand in suspension by means of a filtering arrangement. The car shed and the repairing shops are in the vicinity of the power-station. The tramways were constructed for the Société anonyme des Tramways du Cairo, of Brussels, by a German company, although some of the rolling stock is of British manufacture. Besides passing through the principal streets, the lines go through the fashionable quarter in which European and Turkish dignitaries reside. Germans at that period were prominent. A journey over the various routes affords an opportunity of viewing the life in the streets of an Oriental town as well as the most beautiful parts of what is, to the Westerner, a most interesting city. The lines are in close proximity to the mosques and minarets, palaces surrounded by beautiful parks of Mohammedan and State officials, and to the citadel which majestically rises above the city.

A SMALL ELECTRIC LOCOMOTIVE FOR GOODS TRAFFIC.

The accompanying illustration shows a handy little electric locomotive which is used for goods haulage on the Dublin and Lucan Electric Railway. The vehicle is perhaps unique as to its functions, because besides being a locomotive for hauling wagons, it can carry goods and passengers itself. It will be noted that there are passengers' seats on the platforms, while the closed structure in the centre is a cabin for perishable goods.

The total length of the vehicle over bumpers is 26 ft., the length over platforms is 23 ft., and the width over all is 7 ft. 6 in. The height from the ground



Electric Locomotive—Dublin and Lucan Electric Railway.

to the step is 14½ in. The cabin measures 8 ft. by 5 ft. 6 in., and is fitted with sliding doors suspended on McCabe rollers, while the platforms are 7 ft. 6 in. by 6 ft. The seats provided can accommodate ten persons. A Brill truck with a 7 ft. 6 in. wheel base is surmounted by a heavy section rolled steel frame which carries the superstructure. There are two British Thomson-Houston motors of G.E.58 type, and the controllers are of the same firm's B.18 design. Hand and rheostatic brakes and acetylene and electric lights are provided. The couplers are fitted with Spencer-Moulton rubber springs, and the whole of the drawbar arrangement is hung from the rolled steel frame. The superstructure of the machine was built in the Dublin and Lucan Company's workshops.

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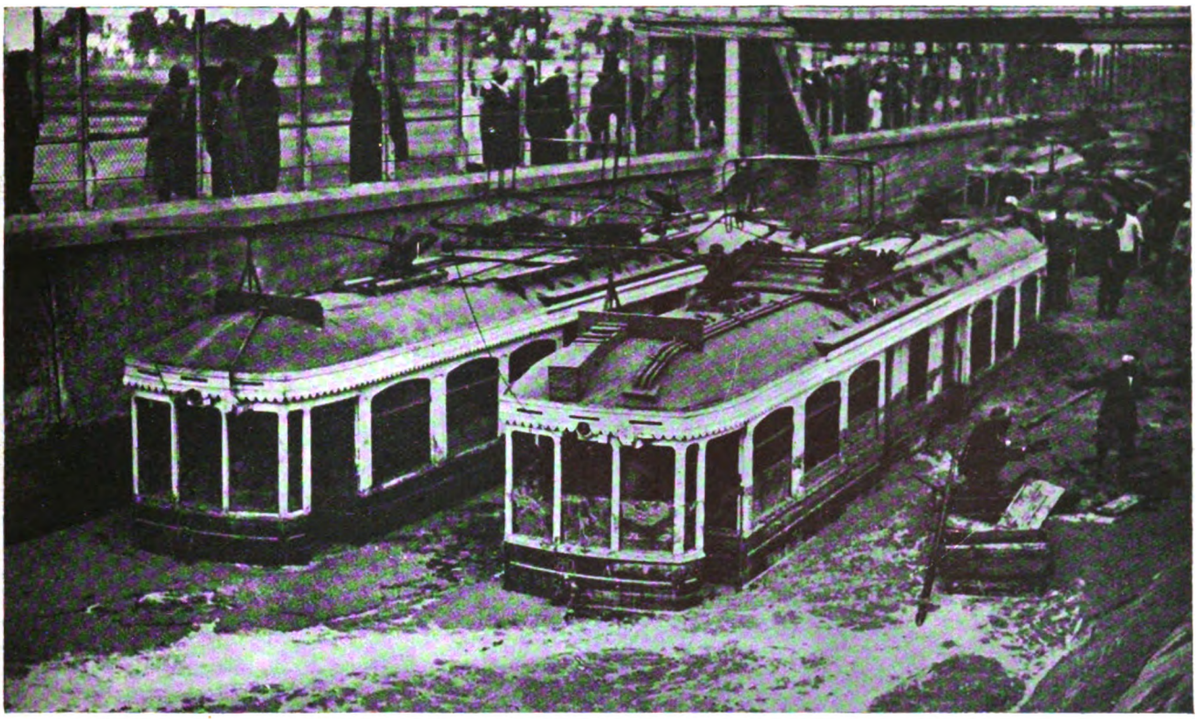

Cairo Electric Cars Buried by Water and Sand.

British Soldiers Extricating the Cars from the Sand after the Flood Subsided.

ELECTRIC CARS OF THE CAIRO RAILWAY AND TRAMWAY SYSTEM CAUGHT BY A NILE DELUGE.

The cars illustrated run from Cairo to Heliopolis and are equipped with both wheel and pentagraph trolleys, the latter being used on the high speed section

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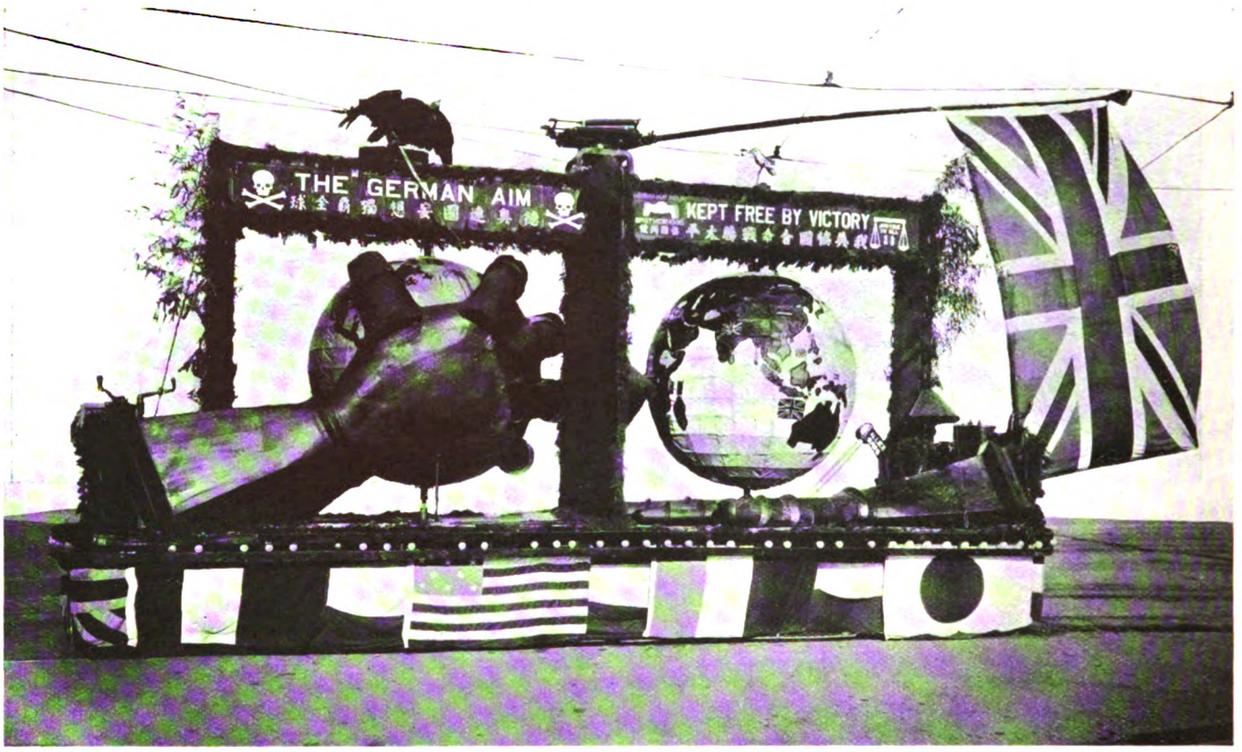
VICTORY CELEBRATION AT SHANGHAI.

Pageant on the Tramways.

Probably a more fitting symbol of the triumph of civilisation over German barbarism has not emanated from British hands than the Victory Car which was the leading feature of the celebration in Shanghai of the signing of the armistice. For this and two other symbolic cars that took part in the pageant credit is due to Mr. D. McColl, the general manager, and his assistants on the staff of the Shanghai Tramways.



Shanghai Tramway Car Symbolising the Allied Victory.

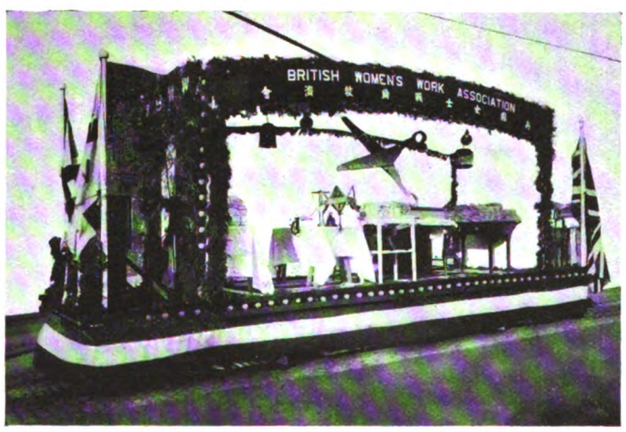
The two illustrations appearing on this page convey some idea of the merits of the cars, and a perusal of a description of the Victory Car will enable the reader to appreciate its effectiveness, which was greatly enhanced when running illuminated at night.

On the Victory Car were mounted side by side two enormous globes of the world, which were illuminated from the inside. One globe was surmounted by a German eagle perched on a sword, above an illuminated sign reading in English and Chinese, "The German Aim." This inscription was flanked on either side by crossbones and skull.

The globe was painted with all the lands black and flying the German flag, and the sea was a dull grey. The globe was stationary, in the grip of an enormous mailed fist. It depicted, graphically, the sinister aim of German militarism to subjugate the whole world and hold it in thrall.

The other globe was surmounted by a dove over an illuminated sign reading, in English and Chinese, "Kept Free by Victory," with the scales of Justice to its left and the clasped hands of "Brotherhood" to its right. This globe (which revolved to typify Freedom and Progress) was painted in bright colours to show all the different countries, each flying its own flag, the sea being a cheerful blue.

Underneath the globe lay the mailed fist, shrunken and battered, and transfixed by a sword designated "Allies." The car also carried the flags of the Allies, which were shown up by strings of electric lamps. Two other cars were representative of agencies which have contributed to the Allies' triumph. One gave an excellent idea of the familiar Tank, which was given a white hue, the reverse of the grimy appearance of the travelling forts that did so much to smash the German defence



Another Car in the Armistice Pageant at Shanghai.

A graceful compliment was paid to the British women of the Settlement by the third car. This depicts the British Women's Work Association in Shanghai, an organisation that contributed a large number of articles that gave comfort to the wounded in the hospitals and aided their recovery.

The Shanghai Electric Construction Company, Limited, are to be congratulated upon having in their tramway officials Brit shers who so well responded to the needs of an historic occasion.

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POSITION OF ITALIAN RAILWAYS AND TRAMWAYS.

The *Socie'á per Azioni* has published an interview with Prof. Tiaini, president of the Federation of Transports, on the position of the Italian Railways and Tramways. The Professor observed that most of the railways in Italy being run by the State, it is forgotten that many railways and tramways are worked by private industry—4,000 kilometres of railway and 5,000 kilometres of town and interurban tramways. These railways and tramways are of great importance; they represent a capital of about three milliards of lire with a gross yield of about a quarter of that of the great State railway system. Dealing with the difficulties caused by the war, and the inadequacy of the increases in the tariffs, which were considerable, and of other concessions, the Professor said that the State ought to take a deeper interest in the affairs of the companies. The concessions already granted are not quite clear, and require a good deal of time allowance.

Owing to the enormous increase in the price of metal materials, both railways and tramways have been obliged to slacken in the maintenance of the rails and rolling stock. The equipment generally has seriously depreciated, and the locomotives and cars run with difficulty.

Preparations should be made at once for the work of reconstitution. The manufactories of projectiles the day when peace is declared will have no more war work, and they will have to turn promptly to the construction of locomotives and cars. The gun foundries will have to start immediately rolling rails. If this is not done the evil will be doubled.

Prof. Tiaini counsels the institution of standardisation of materials in order to effect construction in series at a rapid rate and at prices easy to quote. If after the war, he continued, they wished to provide for themselves they must prepare immediately; for nothing can be improvised. They must build up factories for electrical materials useful for traction work. This requires a certain understanding between users and constructors, because it is not a question of preparing new lines only, but rather by the repair of existing material and the adaptation and provision of equipment, that should be prepared in time. The types of material would have to be submitted for approbation to the Government.

In the years preceding the outbreak of war there was in Italy a considerable development in the construction of railways entrusted to private enterprise; this occurred thanks to legislation granting increased subsidies by the State in order to stimulate such work. It is estimated that roughly there were 6,000 kilometres of railway and as much tramway under construction when the war started. Naturally the war necessitated the suspension of this work, and made the conditions attending the concessions very onerous, so much so that some of them had to ask for a moratorium. As a measure for giving employment to the great quantity of labour that will be liberated by peace, one should begin now to initiate a recommencement of this work.

Sorbitic Treatment of Rails at Bournemouth.—Mr. I. Bulfin, general manager of Bournemouth Corporation Tramways, has been authorised by the Tramways Committee to arrange for the application of the sorbitic treatment of the rails on a mile of single track. Messrs. Scholey and Company, of 56, Victoria Street, Westminster, S.W., have undertaken to carry out the work at a cost of £1 per yard of single track. It is estimated that the treatment, which was described in THE TRAMWAY AND RAILWAY WORLD of April 11, 1918, will add 50 per cent. to the life of the rails.

TRAMWAYS (BOARD OF TRADE) COMMITTEE.

DISSOLUTION OF A WAR TIME ORGANISATION.

The Tramways (Board of Trade) Committee has now been dissolved. During the past month the committee were engaged in winding up their affairs, and the offices in Buckingham Gate were closed on February 28. Although at the outset the committee began their labours amid a great deal of misapprehension, they accomplished some useful work for the industry during the latter part of the war, and it is a matter of regret that such a body was not brought into existence two years earlier. If that had been done it is probable that tramway undertakings would have experienced less difficulty in securing materials to maintain their tracks and cars in running order.

Soon after the formation of the Ministry of Munitions for the purpose of organising the national resources for the production of war material the troubles of tramway proprietors began to assume an acute form. Nor did matters improve when the Ministry set up a Priority Committee for the purpose of allocating such materials as could be spared. Lack of co-ordination was responsible for the failure of the Priority Committee, and at last the President of the Board of Trade decided to appoint the Tramways Committee.

At the outset there was some criticism of the Committee owing to municipal tramway authorities claiming that they should be given more representatives upon it. The Committee was originally constituted as follows:—Mr. James Devonshire (chairman), Mr. A. R. Fearnley, Mr. A. L. C. Fell, Mr. J. B. Hamilton, Mr. R. J. Howley, and Mr. J. M. McElroy, with Mr. J. N. Wilson (Glasgow) as secretary. After some months' service the latter gentleman resigned, and was succeeded by Mr. S. F. James, hon. solicitor to the Municipal Tramways Association. As a result of the objections of the municipal authorities to the constitution of the Committee, Mr. J. Dalrymple, general manager of Glasgow Corporation Tramways, was added to the members before the Committee had actually begun work. The country was divided into nine areas, members of the Committee addressed meetings in each division, and officials were appointed from the constituent undertakings for carrying on the work in collaboration with the Board of Trade Committee.

With the development of the work dissentient voices for the most part ceased to be raised, and in justice to the Priority Committee of the Ministry of Munitions it must be admitted that the operations of the Tramways (Board of Trade) Committee were facilitated by one of the later actions of the former body, namely, the collection of information as to what sections of tramways were of importance in the transport of munition workers. The Tramways Committee's work, amongst other things, was to make arrangements for supplying cars to munitions centres from places where munition work was not carried on, and from towns in which cars were laid by for want of crews. The Committee's operations also comprised authority to require rails to be taken up on sections not of national importance in order to repair and relay tracks upon which cars were run for the conveyance of labour engaged on work of national importance, but very little was done under these powers. Later on, when the position on the Western Front necessitated the transfer of more miners into the army, the Tramways Committee and their area committees assisted in bringing about the restriction of services and other methods for securing a reduction in the consumption of coal in the generating stations.

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THE
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A New Era in Transport.

Where now is *laissez faire?* What has become of individual energy and effort, and the bracing effect of free competition? Where are the doctrines "On Liberty" of John Stuart Mill? What has become of the fundamental principle laid down by Herbert Spencer that the sole legitimate function of the State is to maintain and administer justice? All are gone—blown to pieces by the high explosive of a world-shaking war. For years they had been crumbling, and had reached such a friable condition that their final disintegration was comparatively easy. We are now entering on a new era in which, for good or evil, the control of the State is to be spread over a multitude of human activities. Only in one way can the change be justified, namely, that it should bring with it such a co-ordination and such an increase in human efficiency and comfort that men will not seek to go back to their old liberty. Whether the justification will come or not time alone can show. But the experiment must be made. The immediate example of the activities of a Government which wishes to organise, systematise, co-ordinate, and control almost everything for the benefit of the public, and particularly of the working man, is to be found in the Ministry of Ways and Communications Bill, to which several pages of this issue are devoted. It foreshadows stupendous changes in the transport system of the country. So far-reaching and revolutionary are the proposals that the storms of opposition and criticism have already gathered volume and force. The policy involved will almost inevitably lead to the nationalisation of the railways, and probably of canals, harbours, and electricity supply of the country. That clean sweep may be distant, but it is evidently the goal. On the other hand, the Bill is so drafted that changes in the direction indicated may be made gradually and tentatively, and if undesirable results ensue the policy may be suspended. All sorts of alternatives are feasible, not only because the new Minister has such wide powers, but because important specific steps in the direction of national ownership and management can be authorised by Orders in Council from time to time. Parliamentary control is in this way reduced to a minimum. So far as the railways are concerned, the removal of the Government guarantee of receipts would in many cases mean bankruptcy. The State has during the war put the railways in such a position that the shareholders are entitled to demand protection and fair treatment. That points to nationalisation, with an enormous but remunerative addition to the national debt and with the elimination of wasteful competition. The argument does not apply in the same way to tramways, as these cannot form one co-ordinated system like the railways, and municipal tramways are specifically excluded from compulsory purchase. Their financial difficulty, however, is in some cases even worse than that of the railways. There has been no general 50 per cent. increase of fares, as on the railways, and increases above the statutory maxima can at present only be brought about with difficulty and delay. In one way or another the tramways must have financial relief if they are to be carried on as self-sustaining enterprises. On the general aspect of the scheme it need only further be said that probably no better man than Sir Eric Geddes could be found for initiating and working out the gigantic task which awaits the Minister of Ways and Communications. What it is possible for one man to do he will do; and he will, of course, departmentalise the work, and relegate important duties to assistants. Among them will be enthusiasts in the develop-

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ment of the roads; and they will see to it that the fullest use is made of these and of motor traction compatible with the supreme objects of securing the greatest efficiency and economy in our national system of communications. The Government have, in fact, adopted the policy set out in the first issue of this journal. They propose "to hold the balance evenly between conflicting interests, and steadily to advocate and enforce development, improvement, and advance in every section of transport undertakings." It is an ideal not easily attained, but in proportion as they approach it so we are convinced will the prosperity of the country be consolidated and extended.

London's Linking-up Proposals.

The Metropolis has, from the beginning of tramway enterprise, always had to contend with retrograde influences to which provincial Corporations are happily strangers. For instance, more than a decade had to be spent in fighting strong opposition in both Houses of Parliament before the tramways could be brought over the bridges and connected by a track along the Victoria Embankment. The wonder is that the population of London have tamely submitted to a medieval dominance that no self-respecting provincial town would endure. For that reason it is fortunate—not unfortunate, as one member of the Council suggested—that the present scheme for securing Parliamentary sanction to the linking up of the disjointed tramway system was brought up on the eve of the triennial election. It has the support of all parties, and was carried with only two dissentients. The Bill will therefore go before Parliament as the demand of the ratepayers that their property shall be developed in a commonsense manner, and the public be given facilities for through travel without having, for instance, to walk over the intervening distance of three-quarters of a mile between Blackfriars Bridge and Farringdon Road. The City representative who was rash enough to express opposition repeated the parrot cry that the Farringdon Road and Blackfriars Bridge line would lead to congestion. It is regrettable that the Chairman of the Highways Committee was led by this assertion to suggest that the link should be a single line. That would certainly conduce to congestion. Farringdon Road and Farringdon Street, which are the chief thoroughfares to be traversed by the link, are two of the widest in London, and New Bridge Street is of more than average width. The congestion resulting from a single track would be accentuated at Ludgate Circus, where it is necessary that as many up and down cars as possible should be passed over at one time rather than that cars should be held up at the present terminus at Farringdon Road and on the short length of double line which would branch off from Blackfriars. Even then there would have to be electrical signalling to indicate when up and down cars are free to proceed over the long stretch of single line connection. If the City representatives wish to witness obstruction they should pay a visit any evening to the Blackfriars queues, and note the patient workers from the city standing for an hour and more waiting for a car. This delay, which involves physical injury to children, women, and men, would be averted by the linking up with Farringdon Street, thus enabling thousands of residents south of the Thames to board cars without going down to the Embankment. Equally necessary are all the other north of Thames proposals; and we cannot believe the public will longer allow reactionary interests to delay such imperatively needed improvements in the London tramway system.

A Whitley Council for the Tramway Industry.

The formation of a National Joint Council for the tramway industry is now practically assured. Both municipal and company-owned tramways will come into the organisation, and this circumstance has entailed considerable negotiation, as both the municipal and the company interests have been anxious to preserve a just balance in their respective representations. All outstanding matters have, however, been adjusted, and the draft constitution has been agreed to by the representatives of the tramway undertakings and the employees' union. As soon as the formal approval of the local authorities and the companies has been given to the constitution, which is not likely greatly to delay matters, the scheme will be put into operation. The Council can hardly fail to be of great service to the industry in maintaining harmonious relations between employers and employees and in promoting general efficiency. The text of the constitution is given on the following page.

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NATIONAL JOINT COUNCIL OF THE TRAMWAY INDUSTRY.

TEXT OF THE CONSTITUTION AS APPROVED BY THE CONSTITUENT ASSOCIATIONS.

The constitution of the National Joint Industrial Council for the Tramway Industry has now been approved by the constituent associations. These include the Municipal Tramways Association, the Tramways and Light Railways Association, and the National Transport Workers' Federation. The Joint Council will consist of 44 members, 22 being representatives of the employers and 22 of the employees. Of the employers' representatives 14 will be elected from the members of municipal tramway committees and (or) officers of the tramway departments, and eight from the directors and (or) officers of tramway and light railway companies. The members of the Council will retire annually, and will be eligible for re-election. The National Transport Workers' Federation have undertaken to secure that all the employees of the traffic staffs and the semi-skilled and unskilled men engaged in other branches of the industry shall be represented on the employees' side of the Council.

The text of the constitution is appended:—

OBJECTS.

To secure the largest possible measure of joint action between employers and workpeople by the consideration of matters affecting the well-being and progress of the industry, as part of the national life.

It will be open to the Council to take any action that falls within the scope of this general definition. Among its more specific objects will be the following:—

(*a*) The establishment and definition of the functions of District Councils and Works Committees.

(*b*) The consideration of measures for the inclusion of all employers and workpeople in their respective Associations, and for securing the observance by them of collective agreements.

(*c*) The consideration of wages, hours, and working conditions which affect the industry as a whole.

(*d*) The consideration of the existing machinery for the settlement of differences between the parties and sections in the industry, and the establishment of machinery for this purpose where it does not already exist.

(*e*) The consideration of measures for securing regular employment as far as possible, while providing the public with the most efficient service.

(*f*) The improvement of conditions with a view to removing danger to the health of the workpeople and minimising accidents.

(*g*) The consideration of safeguarding the rights of workpeople inventing or designing improvements in machinery and method.

(*h*) The supervision of entry to and training for the industry, and co-operation with the educational authorities in arranging education in all its branches for the industry.

(*i*) The inquiry into special problems of the industry, including the study of the organisation and methods of the industry in this and other countries, and, when desirable, the publication of reports.

(*j*) The collection of statistics and information on matters appertaining to the industry

(*k*) The representation of the needs and opinions of the industry to the Government, Government Departments, and other authorities.

(*l*) The consideration of matters that may be referred to it by the Government or any Government Department.

(*m*) The consideration of problems of re-construction and labour re-settlement after the war, in so far as they affect the industry.

(*n*) The co-operation with other Joint Industrial Councils and other bodies dealing with problems of common interest.

MEMBERSHIP.

The Council shall consist of forty-four members representative of the industry, being twenty-two representatives of the employers and twenty-two representatives of the employees.

EMPLOYERS' REPRESENTATIVES.

The representatives of Municipal Tramways shall be fourteen in number and be elected from—

(*a*) Members of Tramway Committees and/or

(*b*) Officers of Tramway Departments.

The representatives of the Tramway and Light Railway Companies shall be eight in number and be elected from—

(*a*) Directors of Tramway or Light Railway Companies and/or

(*b*) Officers of Tramway or Light Railway Companies.

EMPLOYEES' REPRESENTATIVES.

The representatives of the employees shall be twenty-two in number and shall be elected as follows:—

(The details of this procedure will be arranged after further conferences with the employees' representatives.)

RE-ELECTION.

The members of the Council shall retire annually and shall be eligible for re-election.

COMMITTEES.

The Council shall have power to appoint from its own members Executive and other Committees, and to define the powers of such Committees. Unless otherwise agreed, such Committees shall be equally representative of both sides of the Council.

OFFICERS.

The Officers shall consist of a Chairman, a Vice-chairman, a Treasurer, and a Secretary or Secretaries. The Chairman and Vice-chairman shall be elected from the members of the Council. When the Chairman is a representative of the employers, the Vice-chairman shall be a representative of the employees, and *vice versa*.

The Council shall be empowered to appoint a Treasurer, a Secretary or Secretaries, and the necessary staff, and shall be empowered to pay to them such remuneration as it may think fit.

MEETINGS OF THE COUNCIL.

The ordinary meetings of the Council shall be held as often as necessary, and not less frequently than once a quarter. A special meeting shall be called on the requisition of one-third of the Council. At least seven days' notice of such special meeting shall be given, and the business of the meeting stated in the notice.

VOTING.

The voting shall be by show of hands or otherwise as the Council may determine.

Subject to the exceptions set forth in the following paragraph, all resolutions shall be regarded as carried if they have been approved by a majority of the members present on each side of the Council

(Here will follow a clause to be agreed between the representatives of the Municipal Tramways Association and the Tramways and Light Railways Association.)

QUORUM.

Not less than one-half of the representatives of each side shall constitute a quorum of the Council.

FINANCE.

The expenses of the Council shall be met by the two sides of the Council in equal proportion.

DISTRICT COUNCILS.

It is provisionally suggested that District Councils shall be established for the following areas, viz.:—

Scotland.
Northumberland and district.
Lancashire, Cheshire, and North Wales.
Yorkshire and Lincolnshire.
South Wales.
Midlands.
Metropolitan District.
South-west and part of South Coast.
East, South-east, and part of the South Coast.

PASSING THE STATIONARY TRAMCAR.

BY-LAW ADOPTED BY THE JOHANNESBURG COUNCIL.

The Johannesburg Municipal Council adopted the following resolution:—

"That in the opinion of the Council the Traffic By-laws should be amended so that it will be an offence against the by-laws for any person to drive a vehicle or ride a horse or other animal or bicycle on the left or near side of any tramcar for the time being for the purpose of taking up or setting down passengers until the roadway is clear of persons entering or leaving such tramcar; provided that any such person may drive or ride such vehicle, horse, or other animal or bicycle past the right or off side of such tramcar if the roadway is sufficiently clear for that purpose."

The licence officer has since reported on the matter, and is of opinion that a by-law in the above form would have a dangerous tendency, inasmuch as it might be interpreted by drivers as giving them a right of way on the right-hand side of the car, and with a number of drivers this would mean a lessening of the exercise of care. It is inadvisable, he thinks, even by implication to lay down the side on which a motor or other vehicle should pass a tram. It should be left to the driver's discretion, and the full responsibility should be his.

To meet the case, the General Purposes Committee considers that the Traffic By-laws should be amended by the addition of the following words:—

"The driver of any vehicle or the rider of any animal, motor cycle, or bicycle shall, when overtaking a tramcar which is not in motion, stop his vehicle, animal, or cycle at a distance of at least 10 feet from such tramcar, and shall not proceed to pass such tramcar until he can do so with safety to the life and limb of every person who has alighted from, or may be about to alight from or to board, such tramcar."

The committee considers that such a regulation would not entail great hardship on drivers of motors or other vehicles. If properly enforced, the stop prior to passing would prevent the rushing past trams without slackening speed which is so often seen, and ensure careful driving past the stationary tramway car.

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MINISTRY OF WAYS AND COMMUNICATIONS.

INTRODUCTION IN THE HOUSE OF COMMONS OF THE BILL FOR ITS ESTABLISHMENT.

FULL TEXT OF THE MEASURE.

In the House of Commons, on February 26, the Home Secretary (Mr. Shortt) under the ten minute rule introduced a Bill to establish a Ministry of Ways and Communications and for purposes connected therewith. Associated with the Home Secretary were Sir Albert Stanley (President of the Board of Trade), Major Baird, and the Attorney-General. Sir Eric Geddes will be the first Minister of the proposed department and the salary of the Minister will be £5,000, and of the two Parliamentary Secretaries, £1,500 each.

The HOME SECRETARY said he did not think it was any exaggeration to say that probably no question was of more importance to the country than that of transport and communications. They could develop no industry in this country unless they had adequate facilities for transport, and unless they had cheap transit. They could do nothing with the housing question or with the development of agriculture unless they could provide adequate transport. In the past they had had many means of transport, but they had had no co-ordination. Roads were no doubt at one time a purely local question, but that was not so now, owing to the introduction of motor and mechanical transport. In August last a Committee was set up to inquire and report as to what steps were desirable to develop internal facilities for transport in the United Kingdom and to acquire effective supervision for co-ordination in order to ensure that such development would be adequate and suitable to meet the requirements of the country. That Committee had arrived at the conclusion that they could not allow the organisation of the transport systems of the country to revert to pre-war conditions. When the control of railways was taken over in 1914 an arrangement was made by which the net receipts of the companies were guaranteed for two years after the termination of the war. The result of that was that the Government proposed to set up a Ministry to maintain for the two years the whole of the control which they had during the course of the war, and at the same time to give them power during those two years to consider the whole question and to make such changes as and when they thought it desirable.

Sir E. CARSON (Duncairn).—Does that mean they will have power to nationalise the railways ?

Mr. SHORTT.—Not without the consent of this House. It was proposed that the Ministry should take control of the railways, light railways, tramways, canals, waterways, and inland navigation. Up to the present the roads had been under diversified control, and it was proposed that roads, bridges, vehicles, and traffic should be included in the Bill. Already a large number of powers were exercised over roads, railways, canals, and tramways by Government departments, but there was no one department which could co-ordinate the whole of the control It was felt that this necessary control and co-ordination was better in the hands of one Minister. It was further proposed to give to the Ministry the control of the supply of electricity. It was suggested that the interests of the railways and tramways so far as electricity was concerned were not those of the consumer of power. The exact opposite was the case. The railways would profit the more industries prospered. Therefore there was every inducement to the railways to see that every individual in the country, every manufacturer, everyone who could improve his business by the use of power, was able to get that power as cheaply as possible. The Bill would require considerable discussion, he had no doubt, and in a matter of that kind they must have a fully ample sketch of its terms.

Sir EDWARD CARSON.—Does it apply to the whole of the United Kingdom ?

Mr. SHORTT.—Yes, and nowhere more than in Ireland.

Mr. RENWICK (Newcastle-on-Tyne).—Will it apply to waterways such as the Manchester Ship Canal ?

Mr. SHORTT.—Yes.

Mr. JOYNSON-HICKS (Twickenham) said that the Bill was going to create the most powerful Ministry ever set up in this country. The Minister at the head of it would have to be a superman. (Laughter.) The House might not know that 208 members had joined the committee he (the hon. member) had formed. He contended that roads and railways should be kept separate. There were 152,000 miles of roads in this country and 2,000 road authorities. He pointed out how the motor interests had grown, and there were now people who lived in roads—were "born in roads"—(general laughter)—at any rate, there were people who ought to have the job of developing the roads. He suggested the revivifying of the Road Board and the co-ordination of the work of two Ministers—one of roads, one of railways—by the Cabinet.

The Bill was read a first time. Its text is as follows :—

A BILL TO ESTABLISH A MINISTRY OF WAYS AND COMMUNICATIONS AND FOR PURPOSES CONNECTED THEREWITH.

Be it enacted by the King's most Excellent Majesty, by and with the advice and consent of the Lords Spiritual and Temporal, and Commons, in this present Parliament assembled, and by the authority of the same, as follows :—

APPOINTMENT OF MINISTER OF WAYS & COMMUNICATIONS.

1.—For the purpose of improving the means of, and the facilities for, locomotion and transport, it shall be lawful for His Majesty to appoint a Minister of Ways and Communications (hereinafter referred to as the Minister), who shall hold office during His Majesty's pleasure.

POWERS AND DUTIES.

2.—(1) It shall be the duty of the Minister to take steps to carry out the purposes aforesaid, and there shall, as from such date or dates, as His Majesty in Council may by Order determine, be transferred to the Minister all powers and duties of any Government Department in relation to—

(*a*) railways ;
(*b*) light railways ;
(*c*) tramways ;
(*d*) canals, waterways, and inland navigations ;
(*e*) roads, bridges, and ferries, and vehicles and traffic thereon ;
(*f*) harbours, docks, and piers ;
(*g*) the supply of electricity ;

including any powers and duties of any Government Department in relation to any railway, light railway, tramway, canal, inland navigation, harbour, dock, pier, electricity, or other undertaking concerned with any of the matters aforesaid, and any powers of any Government Department with respect to the appointment of members or the procedure of the Railway and Canal Commission or of any commissioners, conservancy board, or other body having jurisdiction with respect to any such matters as aforesaid :

Provided that—

(i) His Majesty in Council may by Order except from such transfer any particular powers or duties, or provide for the exercise or performance of any power or duty so excepted by the Minister concurrently or in consultation with or at the instance of the Government Department concerned, or by the Government Department concerned concurrently or in consultation with the Minister, or provide for the retransfer to any such Department of any powers and duties transferred to the Minister by this section ; and

(ii) Nothing in this section shall transfer to the Minister any powers or duties of the Admiralty exercisable in or in relation to ports declared under the Dockyard Ports Regulation Act, 1865, to be dockyard ports, but His Majesty in Council may by Order transfer to the Admiralty, instead of to the Minister, any of the powers of the Board of Trade with respect to dockyard ports, or with respect to the appointment of members of any commissioners, conservancy board, or other body having jurisdiction in the whole or any part of a dockyard port.

(2) His Majesty in Council may by Order make such incidental, consequential, and supplemental provisions as may be necessary or expedient for the purpose of giving full effect to any transfer of powers or duties by or under this section, including provisions for the transfer of any property, rights, and liabilities held, enjoyed, or incurred by any Government Department in connection with any powers or duties transferred, and may make such adaptations in the enactments relating to such powers or duties as may be necessary to make exercisable by the Minister and his officers or by the Admiralty and their officers, as the case may be, the powers and duties so transferred.

(3) In connection with the transfer of powers and duties to the Minister or the Admiralty by or under this Act, the provisions set out in the Schedule to this Act shall have effect.

POWER TO CONTROL TEMPORARILY RAILWAYS, ETC.

3.—(1) With a view to affording time for the consideration and formulation of the policy to be pursued as to the future position of undertakings to which this section applies, the following provisions shall have effect for a period of two years after passing of this Act:

(*a*) Where at the passing of this Act possession has been taken of any railroad undertaking or part thereof in

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pursuance of section sixteen of the Regulation of the Forces Act, 1871, or otherwise, possession thereof may be retained without any renewal of the warrant granted by the Secretary of State in pursuance of that section upon the same terms as to payment as those heretofore in force, and the Minister may exercise over all such undertakings all such powers as have hitherto been exercised by the Board of Trade under the said Act or with the consent of the owners of the undertakings or otherwise, and such other powers as may be conferred by this section or agreed to by the railway companies concerned :

(*b*) The Minister may take possession in the name or on behalf of His Majesty of the whole or any part of any other railway undertaking or of any light railway, tramway, canal, inland navigation, harbour, dock or pier undertaking, or of any plant belonging thereto or used thereon, and of the railway wagons of any private owner required for use on any railway of which possession has been taken, and of any barges, tugs, and other craft required for use on any canal of which possession has been taken :

(*c*) The directors, officers, and servants, of any undertaking of which, or of the plant whereof, possession is retained or taken shall obey the directions of the Minister as to the user thereof and any directions of the Minister—

(i) as to the rates, fares, tolls, dues, and charges to be charged ;

(ii) as to the salaries, wages, and remuneration and conditions of employment of persons employed on or in connection with any undertaking of which possession has been taken ;

(iii) as to the working or discontinuance of the working of the undertaking or any part thereof including directions as to keeping open or closing of any stations ;

(iv) for securing that the permanent way, rolling stock, plant, appliances, or equipment, whether fixed or moving, are satisfactory in type and design ;

(v) as to the carrying out of alterations, improvements, and additions which the Minister considers necessary for the public safety or for the more efficient and economic working of the undertaking ;

(vi) for securing co-operation between undertakings and for securing the common user of facilities, rolling stock and equipment whether fixed or moveable ;

(vii) for affording running powers over their system, or any part thereof, to the owners of any other undertaking ;

(viii) for securing that manufacturing and repairing facilities, and auxiliary and ancillary services shall be used, and the purchase and distribution of stores shall be conducted, in such manner as may be most conducive to economy and efficiency ;

(ix) as to the preparation and submission to the Minister at such times and in such form and manner as the Minister may require of statistics and other returns, and of accounts at such times and in such form and manner as the Minister, with the consent of the Treasury, may, by regulations, prescribe ;

(*d*) For enabling any directions given by the Minister as to alterations, and improvements and additions to be carried into effect the Minister may, by order, authorise the owners of any undertaking to acquire any land and to construct any works, and the order may incorporate the Lands Clauses Acts, subject to such modifications as may be specified in the order, being modifications of those Acts made or authorised to be made by the Development and Road Improvement Funds Act, 1909, or any other enactment, and may incorporate or apply any of the provisions of any enactment relating to the construction, maintenance, or working of railways, light railways, tramways, canals, harbours, docks, and piers ;

(*e*) Any rates, fares, tolls, dues, and other charges directed by the Minister shall be deemed to be reasonable, and may be charged, notwithstanding any statutory provisions limiting the amount of such charges or increases therein.

(2) There shall be transferred to the Minister any officer or servant of an undertaking of which possession is retained or taken under this Act whose services the Minister may require, either permanently, with the consent of the officer of servant, or temporarily, with the consent of the undertakers.

In either case until the expiration of two years from the passing of this Act or the acquisition of the undertaking by the Minister, whichever may be the earlier, such officer or servant shall remain a full member of any pension or superannuation fund established in connection with the undertaking with all the rights to which he would be entitled had he continued in the service of the undertakers, and *any contributions payable under the rules of the pension or superannuation fund by the undertakers may be paid by the Treasury out of moneys provided by Parliament*, but no officer or servant whose services are so transferred shall be in any worse position as regards salary or superannuation than he would have been had his services not been transferred, and he shall be entitled to receive such reasonable allowance for temporary disturbance as the Minister may determine, with the consent of the Treasury.

This sub-section shall apply to members of the staff of the Railway Clearing House in like manner as to officers and servants of undertakings of which possession has been taken, and, as respects officers and servants who are members of the railway clearing system superannuation fund, to that fund as if it was a pension or superannuation fund established in connection with an undertaking of which possession has been taken.

(3) Section twenty of the Local Government (Emergency Provisions) Act, 1916 (which relates to the establishment of new routes for omnibuses), shall continue in force until the expiration of two years after the passing of this Act.

(4) Where by reason of the exercise of the powers under this section the value of any undertaking has been depreciated or enhanced, the owners of the undertaking shall, so far as any loss is not provided for by the payments mentioned in paragraph (*a*), be entitled to be recouped or liable to pay the amount by which that value has been so depreciated or enhanced, and if any question arises as to that amount or otherwise with respect to the financial relations between the Minister and any person affected by the exercise by the Minister of any of his powers under this section, the question shall be determined by the Railway and Canal Commission ; and without prejudice to any other form of payment or satisfaction, the Treasury on the recommendation of the Minister may, as or as part of the consideration for exercising any powers of control under this section, guarantee the payment of any dividends on any stock or other securities issued by the owners of an undertaking up to such amount as may be agreed, or the payment of any working expenses of the undertaking, *and any sums required to fulfil any such guarantee shall be paid out of moneys provided by Parliament.*

(5) The provisions of the Railway and Canal Traffic Act, 1888, as amended by any subsequent enactment, relating to the procedure for the determination of questions by the Commission under that Act, including the provisions relating to appeals, shall apply to the determination of questions referred to the Commission under this section, as if they were herein re-enacted and in terms made applicable to this Act :

Provided that—

(*a*) the Commission may, in any case in which they think it expedient to do so, call in the aid of one or more assessors, specially qualified, and hear the case wholly or partially with the assistance of such assessors ;

(*b*) the Commission may hold a local inquiry for the purposes of this section by any one of their members, or by any officer of the Commission or other person whom they may direct to hold the same, and the said provisions of the Railway and Canal Traffic Act, 1888, except the provisions relating to appeals, shall, so far as applicable, apply to such inquiries, and any officer or person directed to hold an inquiry shall have power to administer oaths and shall report the result of the inquiry to the Commission ;

(*c*) the Commission may act by two of their members, one of whom shall be the judge ;

(*d*) the discretion of the Commission with respect to costs shall not be limited in the manner provided by section two of the Railway and Canal Traffic Act, 1894.

POWER TO ACQUIRE RAILWAY & OTHER UNDERTAKINGS.

4.—(1) His Majesty in Council may at any time after the passing of this Act by order authorise the Minister—

(*a*) to purchase by agreement or compulsorily and work the whole or any part of any railway, light railway, tramway, canal, waterway or inland navigation, harbour or dock undertaking the acquisition of which is, in the opinion of the Minister, expedient for improving facilities for locomotion and transport :

Provided that the order shall not authorise the purchase otherwise than by agreement of any tramway undertaking belonging to a local authority, or the purchase, without the consent of the local authority, of any tramway undertaking which a local authority are, under section forty-three of the Tramways Act of 1870, entitled to purchase, but where the local authority give such consent the Order may provide for the transfer to the Minister of the rights of the local authority under that section to purchase the tramway undertaking ;

(*b*) to enter into and carry into effect agreements with the owners of any such undertaking for the placing of the undertaking or any part thereof under the control of the Minister to such extent and subject to such financial arrangements as with the consent of the Treasury may be agreed ;

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(*c*) himself to establish any such undertaking and to work and maintain the same, and for that purpose to acquire any lands either by agreement or compulsorily, and the order may incorporate the provisions of the Lands Clauses Acts, subject to such modifications as may be specified in the order, being modifications of those Acts made or authorised to be made by the Development and Road Improvements Funds Acts, 1909, or any other enactment, and the Order may incorporate or apply any of the provisions of any enactment relating to the construction, maintenance, or working of railways, light railways, tramways, canals, harbours, docks, and piers;

(*d*) to lease the whole or any part of any undertaking so acquired or established;

(*e*) to purchase or take on hire and lease railway wagons belonging to any private owners;

(*f*) to establish, maintain, and work transport services by land or water;

and it shall be lawful for the owners of any undertaking to which any such Order applies to enter into and carry into effect any agreement authorised by or required for the purposes of the Order.

(2) An Order in Council under this section authorising the purchase of any undertaking or part thereof may provide for vesting the undertaking or part in the Minister either subject to any mortgages, debentures, debenture stock, or other charges and obligations affecting the undertaking or discharged therefrom or from any of them, and for preserving the rights and security of the persons entitled to such charges, or for giving them a substituted charge on the consideration paid for the undertaking, and may provide for the transfer to the Minister of officers and servants of the undertaking, and shall secure that no officer or servant so transferred shall be in a worse position as respects tenure of office, remuneration, or superannuation allowances than if no such Order had been made, and any Order made under this section may contain such incidental, consequential, and supplemental provisions as may appear to be necessary or proper for the purposes of the Order.

(3) The consideration for the undertaking or property so acquired shall, in default of agreement, be determined by a court of arbitration constituted in accordance with the provisions of the Order authorising the acquisition.

(4) Any capital sum payable under an agreement or award may be discharged in whole or in part, if the Treasury so direct, by the issue of securities, and the amount of such securities equivalent to such capital sum shall, in default of agreement, be determined by a court of arbitration constituted as aforesaid.

For that purpose the Treasury may create and issue securities the interest on which shall be charged on the revenues of the undertakings transferred after the payment thereout of working expenses, and if and so far as such revenues are insufficient on the Consolidated Fund of the United Kingdom, or the growing produce thereof, and which shall bear interest at such rate and shall be subject to such conditions and regulations as to repayment, redemption, or otherwise as the Treasury may direct or prescribe, and the regulations may apply with the necessary modifications any of the enactments relating to Local Loans Stock.

(5) Where an undertaking is so acquired or established as aforesaid the Minister shall, unless and until he leases the undertaking, operate it in the national interest in such way as he thinks best calculated to give efficient service and facilities, and he shall be entitled to fix such rates, fares, tolls, dues, and other charges as he thinks fit, notwithstanding any statutory provision limiting the amount of such charges or increase therein affecting the undertaking, and shall have all such other powers of management as may be necessary for the purpose:

Provided that the Minister may, if he thinks fit, discontinue the working of any part of the undertaking where he considers such discontinuance is expedient in the national interest.

(6) The expenses of working undertakings acquired or established by the Minister under this section shall be paid out of the revenues of the undertakings, and the Minister shall keep such accounts of the receipts from and expenditure on the undertakings and in such form and those accounts shall be audited in such manner, as the Treasury may prescribe.

(7) Before an Order in Council is made under this section, a draft thereof shall be laid before each House of Parliament for a period of not less than 30 days during which that House is sitting, and if either of those Houses before the expiration of those 30 days presents an address to His Majesty against the draft, or any part thereof, no further proceedings shall be taken thereon without prejudice to the making of any new draft order.

(8) For the purposes of this Act the expression "undertaking" includes any shipping or other services carried on as ancillary to the principal business of the undertaking, and all rights, powers, authorities, and privileges belonging to or enjoyed by the owners of the undertaking in connection therewith, and all property, including cash balances, reserve funds, investments, and all other interests and rights in, to, and out of the property, and obligations and things in action in the possession or belonging to the owners in connexion with the undertaking, or held in trust for purposes connected with the undertaking, and all books, accounts, and documents relating thereto.

POWER TO MAKE ADVANCES FOR CERTAIN PURPOSES.

5.—(1) The Minister may, subject to the approval of the Treasury, *make advances out of the moneys provided by Parliament* to any authority, company, or person, either by way of grant or by way of loan, or partly in one way and partly in another, and upon such terms and conditions as he thinks fit for any of the following purposes:—

(*a*) The construction, improvement, or maintenance of railways, light railways, or tramways:

(*b*) The construction, improvement, or maintenance of roads, bridges and ferries:

(*c*) The construction, improvement, or maintenance of harbours, docks, or piers:

(*d*) The construction, improvement, or maintenance of canals or inland navigations:

(*e*) The promotion and improvement of transport services by land or water:

and the power of the Treasury on the recommendation of the Development Commissioners to make advances for any of the purposes aforesaid shall cease and determine.

(2) For the purpose of advances for the construction, improvement, or maintenance of roads the Minister may classify roads in such manner as he thinks fit.

POWER TO REQUIRE STATISTICS AND RETURNS.

6.—It shall be the duty of the owners of any railway, light railway, tramway, canal, inland navigation, dock, harbour, pier, or electricity undertaking, and the authority or person liable to maintain any road or bridge, to furnish to the Minister at such times and in such manner and form as he may direct, such accounts, statistics, and returns as he may require for the purposes of his powers and duties under this Act.

POWER TO HOLD INQUIRIES.

7.—(1) The Minister may hold such inquiries as he considers necessary or desirable for the purposes of this Act, and the Minister and, if authorised by the Minister, the person appointed to hold any such inquiry, may by order require any person, subject to the payment or tender of the reasonable expenses of his attendance, to attend as a witness and give evidence or to produce documents at the inquiry, and if any person fails without reasonable excuse to comply with any of the provisions of any such order he shall be liable on summary conviction to a fine not exceeding five pounds, and the person holding the inquiry shall have power to take evidence on oath and for that purpose to administer oaths.

(2) Notices of inquiries may be given and published in accordance with such general or special directions as the Minister may give.

(3) The powers of the Minister under this section shall be in addition to and not in derogation of any powers of holding inquiries transferred to him from any other Government Department under this Act.

STAFF AND REMUNERATION.

8.—(1) The Minister may appoint such secretaries, officers, and servants of the Ministry as the Minister may, subject to the consent of the Treasury as to number, determine.

(2) *There shall be paid out of moneys provided by Parliament to the Minister an annual salary not exceeding five thousand pounds, and to each of the Parliamentary secretaries of the Ministry an annual salary not exceeding fifteen hundred pounds, and to the other secretaries, officers, and servants of the Ministry such salaries or remuneration as the Treasury may from time to time determine.*

(3) *The expenses of the Ministry, to such amount as may be sanctioned by the Treasury, shall be paid out of moneys provided by Parliament.*

(4) There shall be transferred and attached to the Ministry such of the persons employed under any other Government Department in or about the execution of the powers and duties transferred by or under this Act to the Minister, as the Minister and the other Government Department, with the sanction of the Treasury, may determine.

(5) The Minister may from time to time distribute the business of the Ministry amongst the several persons transferred or attached thereto in pursuance of the foregoing provisions of this section in such manner as he may think right, and those officers shall perform such duties in relation to that business as may be directed by the Minister:

Provided that such persons shall be in no worse position as respects the tenure of office, salary, or superannuation allowances than they would have been if this Act had not been passed.

SEAL, STYLE, AND ACTS OF MINISTER.

9.—(1) The Minister may sue and be sued by the name of the Minister of Ways and Communications, and may for all purposes be described by that name.

(2) The Minister shall have an official seal, which shall be officially and judicially noticed, and shall be authenticated by the signature of the Minister, or of a secretary, or any person authorised by the Minister to act in that behalf.

(3) Upon and by virtue of the appointment of any person to be Minister, the benefit of all deeds, contracts, bonds, securities, or things in action, vested in his predecessor at the time of his predecessor ceasing to hold office, shall be transferred to and vested in and enure for the benefit of the person so appointed, in the same

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manner as if he had been contracted with instead of his predecessor, and if his name had been inserted in all such deeds, contracts, bonds, or securities instead of the name of his predecessor.

(4) Subsections (2) to (4) of section eleven, and subsections (2) and (3) of section twelve of the New Ministries and Secretaries Act, 1916, shall apply to the Minister and the Ministry of Ways and Communications and to the office of Minister of Ways and Communications in like manner as they apply to the Ministers and Ministries mentioned in those sections.

ABILITY OF MINISTER AND SECRETARIES TO SIT IN PARLIAMENT.

10.—(1) The office of Minister of Ways and Communications, or of the secretary in the Ministry of Ways and Communications, shall not render the holder thereof incapable of being elected to or sitting or voting as a member of the Commons House of Parliament, but not more than two such secretaries shall sit as members of that House at the same time.

(2) The person who is first appointed to be Minister shall not by reason of such appointment, if a member of the Commons House of Parliament, vacate his seat as such member.

SHORT TITLE AND INTERPRETATION.

11.—(1) This Act may be cited as the Ministry of Ways and Communications Act, 1919.

(2) In this Act the expression "government department" includes any Government or other public department, and any Minister of the Crown acting as the head of a Government Department, and for the purposes of this Act the Light Railway Commissioners and the Road Board and the Lord Lieutenant and Privy Council of Ireland shall be deemed to be Government Departments.

(3) Any Order in Council under this Act may be altered or revoked by a subsequent Order.

SCHEDULE.

TRANSITORY PROVISIONS.

1.—In the construction and for the purposes of any Act of Parliament, judgment, decree, order, award, deed, contract, regulation, by-law, or other document passed or made before the transfer to the Minister or Admiralty from any other Government Department of any powers or duties by or under this Act, but so far only as may be necessary for the purpose of such transfer, the name of the Minister or Admiralty shall be substituted for the name of the other Government Department.

2.—Where anything has been commenced by or under the authority of any other Government Department before the transfer to the Minister or Admiralty of any powers or duties by or under this Act, and such thing is in relation to the powers or duties so transferred, such thing may be carried on and completed by or under the authority of the Minister or Admiralty.

3.—Where at the time of the transfer of any powers or duties by or under this Act any legal proceeding is pending to which any Government Department is a party, and such proceeding has reference to the powers and duties transferred by or under this Act, the Minister or Admiralty shall be substituted in such proceeding for the other Government Department, and such proceeding shall not abate by reason of the substitution.

UNDERGROUND EFFICIENCY MEETINGS.

The fifth meeting of the fourth series of efficiency meetings of the operating staff of the London Underground Railways and London General Omnibus Company, Limited, was held on February 18, at the L.G.O.C. Training School, Chelsea, Mr. H. E. Blain, operating manager, presiding over an attendance of over 200 members of the central staff of the associated undertakings.

A paper on "Railway Maintenance—Civil Engineering" was read by Mr. Arthur R. Cooper, M.Inst.C.E., Engineer to the Underground Railways, and dealt in an exceedingly interesting and practical manner with the general organisation of the Civil Engineering Department—practice in regard to permanent way, illustrating types of track, rail fractures, sleepers and fastenings, sanitation and drainage, slips and pumps; electrical equipment of track, including notes on voltage, insulators, cable supports, etc.; signalling, including automatic fogging, lamp signals, speed control, and wireless installations, various types of railway works, including bridges, viaducts, the use of ferro-concrete, and general notes on station maintenance; lighting problems, such as the glare effect, variation in intensity, nature of surrounding surfaces, etc.; the ventilation of tube railways, with some interesting notes on temperature, the piston action of trains, etc.; and a description of new works, such as the Earls Court flying junction.

The paper was illustrated with a large number of slides, and resulted in an interesting discussion, which was opened by Mr. A. R. McCallum, chief assistant to the Railway Mechanical Engineer, and Mr. H. L. Stallan, maintenance electrician, Engineering Department, L.G.O.C.

A vote of thanks was accorded to Mr. Cooper on the motion of Mr. Roger Smith, chief electrical engineer to the Great Western Railway, seconded by Mr. H. E. Roberts, London Divisional Engineer to the South Eastern and Chatham Railway.

LIVERPOOL CORPORATION'S SHELL OUTPUT.

A Two Millions Record under the Direction of the Tramways General Manager.

Fine Work of Women.

From June, 1915, to the cessation of hostilities there were turned out from the Liverpool municipal shell factories upwards of 3,000,000 high-explosive shells—an achievement of which the city may well be proud, and one which is all the more creditable in that the bulk of the workers comprised women. We are indebted to the *Liverpool Post* for the following account of the undertaking:—

The genesis of the effort dates back to April, 1915, when the chairman of the Tramways Committee (Alderman Russell-Taylor) and the general manager (Mr. C. W. Mallins) were authorised by the committee to interview the then Minister of Munitions (Mr. Lloyd George), and offer him the use of the Lambeth Road works for the purpose of the manufacture of shells. The interview took place on May 31, and on Juue 4 Mr. Lloyd George came to Liverpool and addressed a meeting in the Town Hall, at which it was decided to go full steam ahead with the manufacture of shells at the Lambeth Road car works. Great difficulties were encountered at the outset owing to the shortage of machine tools, but patriotism stimulated private firms to come to the rescue and lend lathes and other plant to the Corporation. Shell-making operations were actually commenced on June 21, 1915. It is a noteworthy fact that the Lambeth Road works were amongst the first shell factories in the country to employ female labour. Ultimately the factory utilised no less a proportion than 85 per cent. of female labour. The first lot of 18-lb. high-explosive shells was completed on October 20, 1915, these being the first shells finished and "passed" by any of the national shell factories in the Lancashire area. By July, 1916, the works were manufacturing at the rate of 2,000 18-lb. high-explosives per week. Then there was a hustle, and the output was vastly increased.

An important change ensued a few months later. At the request of the Ministry of Munitions, Lambeth Road works, besides continuing manufacture, became a species of rectification depot for the treatment of shells not fully completed at a large number of small outside factories. The total of outside shells thus rectified or finished varied from 12,000 to 21,000 per week.

The total capital expenditure on the factory, including the purchase and installation of machine tools, was only about £23,000—a remarkably low aggregate. The cost of producing an 18-lb. high-explosive shell in some private factories in the country was 8s. and 9s.; at the Lambeth Road factory the cost was not more than 2s. 2d. per shell.

From the date operations were commenced to the date of signing of the armistice the numbers of shells completely manufactured or rectified and finished were:—

18-lb. high-explosive	...	...	...	...	...	1,906,389
4·5 " "	...	...	...	...	...	185,696
2·75 " "	...	...	...	...	...	40,850
60-lb. " "	...	...	...	...	...	6,569
15-lb. " "	...	...	...	...	...	1,795
	Total	...	...	...		2,141,299

Besides making shells, the Lambeth Road factory has assisted in the manufacture of aircraft. Three hunderd Avro main planes were made, and a second order for 200 main planes of the Sopwith Snipe type was being completed when hostilities ceased. The supervision and management of the factory have been in the hands of Mr. C. W. Mallins, the general manager of the tramways, and Alderman Russell-Taylor has been acting chairman of the committee which has controlled this splendid enterprise.

In addition to the factory of the Tramway Department, the Liverpool Corporation have had another shell-making works at the North Haymarket, under the control of the city engineer, capable of producing 20,000 18-lb. high-explosive shells per week. It will be recollected that King George visited this factory in May, 1917. The total of shells completed and delivered to the Government at this factory was as under:—

18-lb. high-explosive	...	...	...	...	...	245,672
4·5 " "	...	...	...	...	...	443,211
6-in. " "	...	...	...	...	...	303,198
	Total	...	...	...		992,081

From the establishment of this factory to its demobilisation 32,252 tons of shells were manufactured.

The total expenditure, exclusive of machines, tools, and other plant bought and paid for by the Liverpool Munitions of War Committee, amounts approximately to £700,000, of which sum £510,000 has been distributed in wages, the weekly wage bill averaging about £3,800

Mr. H. Dickinson, the city electrical engineer, and his staff have rendered great service in connection with the production of this colossal total of over 3,000,000 shells by providing the electrical energy for the power and light.

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THE RECONSTRUCTION & DEVELOPMENT OF EDINBURGH CORPORATION TRAMWAYS.

A Report by the General Manager, Mr. R. S. Pilcher.

I have submitted to the Tramways Committee different reports concerning the present position of the tramway system and the arrangements which require to be made preparatory to the Corporation working the system on June 30 next; I have also reported upon the provision of supplies and the engagement of the necessary staff. I now propose to report to the Tramways Committee on the latter portion of the remit, viz., "The Future Arrangements for Reconstruction and Development of the System.* as follows:—

The last report on this subject was the report by Messrs. Brodie, Hamilton and Campbell, dated October, 1916. This report dealt with various forms of traction, and made certain recommendations, but the most important portion of it was that which dealt with the problem of whether an electric system could be introduced on the expiry of the lease of June 30, 1919.

As the construction of the power station at Portobello was subsequently stopped by the Board of Trade, and it was found impossible to obtain any class of material except for war purposes, the question of electrification of the system was postponed until after the declaration of peace.

The problem is now somewhat different from what it was in October, 1916, inasmuch as the Corporation will be shortly operating the system, and will have free access to the rails and properties for any change which the Corporation may decide upon.

The problem appears at present to resolve itself into the following questions, all of which I propose to deal with:—

(1) Whether the cable system is to be retained, or whether it is to be superseded by some other form of traction?

(2) Which form of traction should supersede the cable system?

(3) Assuming that electric traction is to be adopted, when should the conversion and reconstruction commence?

(4) In what manner should conversion and reconstruction be carried out?

(5) Which of the proposed extensions and developments should be carried out at the time of reconstruction?

I.—Whether the Cable System is to be Retained, or Whether it is to be Superseded by Some Other Form of Traction?

The disadvantages of the cable system are so apparent to the citizens of Edinburgh that I hesitate to enumerate or enlarge on them, but I think it would be as well to mention some of them in order to form a comparison with an electric system.

The cable cars are not well lighted; oil headlights are used, and acetylene gas for the interior. The platform, stairs, and top deck of open cars are not lighted. The acetylene lights are intense to the eye, and they frequently leave an unpleasant odour. Electric cars can be well lighted with a soft light, whilst platforms, top decks, and stairs can be easily lighted and different signal and route lights provided.

Cable cars are not easily controlled; the cars are stopped by a hand lever brake, which in emergency is slow in action. The cable car cannot be reversed, which in operation is a great disadvantage. Electric cars can be easily adapted for different kinds of power emergency brakes, which, when operated efficiently, reduce the number of accidents. Electric cars can be reversed, and when breakdowns or blockages occur this proves of great convenience in rearranging the services.

The type of lifeguard fitted on to the cable cars is not automatic in its action. On the electric cars there is no difficulty in fitting an efficient automatic lifeguard, and this apparatus would be the means of preventing many serious accidents.

It is possible, with care, to operate cable cars smoothly, but it is noticeable in practice that the cars frequently jerk violently when the gripper is taking hold of the rope. This is dangerous to passengers who have just boarded the cars, and have not had time to be seated, or who are in the act of mounting the stairs.

The cable system requires the exercise of great care on the part of the drivers; especially is this so when nearing the junction and curves where it is necessary to change the gripper from one rope to another. If the gripper is not released at the proper time the rope is cut. The care which is required causes delay in approaching the junctions, and consequent congestions. It is particularly noticeable at the Post Office junction, at the St. Andrew Street and Princes Street junction, and at the West End. The delay is not only annoying to the passengers, but it adds to the number of cars required for a given service, and consequently increases the operating expenses. Owing to this congestion at the Princes Street junctions, the cable system as laid out in Edinburgh has reached its limit. On Saturdays, and at other busy times, when over 170 cars are in operation, it is noticeable that there are numbers of cars waiting to take the curves. On some of the curves the auxiliary ropes are not used, and in consequence require a dangerous speed to be obtained by the car in order to be carried by its own momentum to the correct stopping place. In the event of the car stopping short, it is a familiar sight to see a dozen tramways' employees manipulating bars and pushing the car to its correct place. The traffic in Edinburgh has increased to such an extent that the cars are unduly crowded at certain times; yet if more cars were placed along the routes which run along Princes Street no more passengers could be carried owing to the headway limit having been reached at the junctions. With the overhead electric system no delay would be experienced at these junctions.

One of the disadvantages of the cable system is the time taken to turn a car at a crossover; the number of cars which can be turned on a busy route is strictly limited. It therefore follows that more cars are sent to the extreme terminus than is warranted by the traffic, whilst within the mile radius of the centre of the city there are insufficient cars for the public requirements. This delay is noticeable at Salisbury Place and at Morningside Station. Electric cars can be speedily turned when and where required, and in consequence the exact traffic requirements are more easily and efficiently provided for.

The capital cost of the cable system is very heavy compared with other forms of traction, and this adversely affects proposed extensions; new lines would only be warranted where the traffic was dense. On the other hand, an electric scheme lends itself to extensions, and the forms of construction can be cheapened when passing through rural districts.

The outstanding effect of the cable system is that when a cable becomes stranded or cut it causes a whole route to be stopped for four or five hours. This disorganises the life of the city, because in these days the citizens depend very largely upon the tramway system. Such breakdowns are unknown in connection with an electric system.

I might mention other disadvantages which are more or less apparent to the public, but I think that the facts I have indicated are sufficient to show that the cable system has fulfilled the most that it is capable of, and as the traffic of the city of Edinburgh is likely to increase more in the future, the inconvenience, delays, and breakdowns would become correspondingly more pronounced. In these circumstances I have no hesitation in recommending the committee to discontinue the cable system and to adopt a more reliable and progressive form of traction.

II.—Which Form of Traction Should Supersede the Cable System?

This question was very fully dealt with in the report of Messrs. Brodie, Hamilton and Campbell. In this report they dealt with electric traction, overhead, conduit, and surface contact systems, also "self-propelled" vehicles and motor omnibuses. The conclusion they came to was "that the overhead electric system is the most reliable, convenient, and economical system which can be provided to adequately fulfil all the demands of the city of Edinburgh and its suburban area." With this conclusion I am in complete agreement. There are, however, some special features which require consideration in applying this system to the Edinburgh tramways, with which I propose to deal.

Overhead Equipment.

There are several types of overhead equipment construction:—

(1) Span wire.

(2) Centre pole.

(3) Side pole and bracket arm.

The span wire construction is used where there is an objection to centre poles, and where the roadway is too wide to use bracket arms. The span wire is attached to supporting columns on either side of the roadway. Where there are buildings available the span wire is attached to the buildings by means of brackets called rosettes, and this avoids the erection of poles on the pavement. This form of overhead construction is simple and efficient in operation. The span wire form of construction I would recommend to the committee for all parts of the system with the exception of Leith Walk and Princes Street. In Leith Walk the roadway is particularly wide (23 yards), and is not suitable for span wire construction. I would therefore suggest to the Committee the advisability of continuing the centre pole construction, which is the same form of construction as is used by the Leith Corporation. This would harmonise with the existing electric light scheme in this thoroughfare. The electric light standard could, if desired by the Electric Lighting Committee, be replaced by steel poles suitable for the suspension of tramway wires. The electric light could then be fitted on to the top of the columns. This arrangement would continue up to Broughton Street, where the span wire construction would start.

*Motion by Councillor Harrison and Dean of Guild Neil M'Leod:—

Remit to the Tramway Committee to consider and report as to the present position of the tramway system generally, the arrangements which require to be made in view of the management of the tramways being undertaken by the Corporation on the expiry of the tramway lease on June 30 next, including the provision of necessary supplies and equipment, the engagement of the necessary staff, and other matters connected with the establishment of a Tramway Department, and also the future arrangements for reconstruction and development of the system, with power to obtain a report or reports from the tramway manager, Mr. Pilcher, on these matters.

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PRINCES STREET.

The problem of the Edinburgh tramway system has always been centred round Princes Street. This is but natural; such a street, unrivalled in its beauty and in its unique setting, both of historical interest and natural beauty, is bound to receive very careful consideration from the civic authorities. At the time when Edinburgh adopted the cable system it was probably this question more than any other which influenced the Council in favour of the cable system. The problem now is whether the electric conduit or overhead electric system is to be installed. If the electric conduit is installed, the cost of this line would be double what an ordinary overhead system would cost, and in addition the whole of the rolling stock would require to be provided with dual wiring and collectors for both the conduit and overhead systems; however, this is not the greatest objection. At the west end of Princes Street there would be three junctions; at the east end there would be three junctions; and three intermediate junctions would be required for the routes which would probably join up with Princes Street —making in all nine junctions (Fig. 1). At each of the junctions where regular services are operated it would be necessary to provide movable ploughs, which would be fastened on to the cars as they proceed on to Princes Street, and which would be uncoupled when they left Princes Street. During the time the plough or collector is attached, the trolley pole would be locked down and out of use. This is the system now adopted in London after considerable experience with the dual system.

The change from one system to the other at the junctions means delay, and materially affects the efficiency of the whole system, in addition to which the cost of providing pointsmen at the junctions would be not less than £800 per annum. With the conduit system there is also greater risk of breakdowns due to water, snow, and damaged ploughs than there would be with the overhead, and the risk of breakdown would probably necessitate the building of an emergency line of tramway along George Street. If the Council decided to instal the conduit system in Princes Street, overhead wires would require to be temporarily erected from centre poles until such times as the cable conduits could be removed and the electric conduits built.

If the overhead system is to be used there are two methods of arranging it, either to adhere to the present position of the track and erect overhead wires from the centre poles, or to build the new track on the south side of the street and to suspend the overhead wires on artistic side columns fitted wth bracket arms; the latter arrangement would be preferable, the standards being close to the foliage. This plan would provide a wide street for vehicular traffic, suitable islands being left at the crossings. One advantage with this scheme would be that the permanent way could be finished and ready to connect up at the east and west end as soon as this section of the cable system was ready to be converted.

After giving this question careful consideration, I personally would favour the scheme which places the tramway along the south side of the street, with overhead wires. However, it is for the Corporation and the citizens to decide this question, keeping in view that the conduit will never give the same satisfaction, and the system will be subject to annoying delays in the very heart of the city. The London County Council operate the dual system, but find it very unsatisfactory, and have decided to equip all new lines with the overhead system. Edinburgh, after its recent experiences, should be equipped with the most efficient system of traction; indeed, if it is not, the privately owned motor omnibuses may enter into active competition for the local traffic.

Any proposal to withdraw the cars from Princes Street in favour of George Street should not be seriously considered, because I am convinced that the great majority of passengers wish to pass to and from their destinations *via* Princes Street, which at present has also a heavy short-distance traffic. To withdraw the tramways from Princes Street would simply be to encourage the motor omnibus traffic along this street.

III.—ASSUMING THAT ELECTRIC TRACTION IS TO BE ADOPTED, WHEN SHOULD THE CONVERSION AND RECONSTRUCTION COMMENCE?

I believe that if the citizens of Edinburgh were to express an opinion on the above question it would be "as soon as possible." However, I propose to deal with several points which require consideration in answering this question.

In another part of this report I have pointed out that the cable system as at present constructed has reached its limit in the city of Edinburgh, and I have indicated the reasons why. The traffic of the future could not be handled without radical movement being introduced in order to remove the causes of congestion in Princes Street; this constitutes one reason for conversion as early as possible.

With reference to rolling stock, it is not at all probable that the committee would seriously consider the provision of more rolling stock and shed accommodation suitable for the cable system, and therefore there are strong reasons for at once proceeding with the electrification of a portion of the undertaking in order to provide additional cars. The top-covered cable cars so displaced by the new electric cars could be used to improve the service on the other routes until such times as these sections could in turn be electrified.

There is the financial aspect of this question to consider. The total capital expenditure incurred on the undertaking up to May 15, 1918, is £1,594,806. The amount which is expected to be outstanding on June 30, 1919, will be fully £400,000, to which has to be added the cost of cars, stores, etc., taken over from the Tramway Company. This would be a large amount of debt to add to a new electric undertaking if it did not represent real tangible assets. For the information of the committee I show some items of the capital expenditure on the present system:—

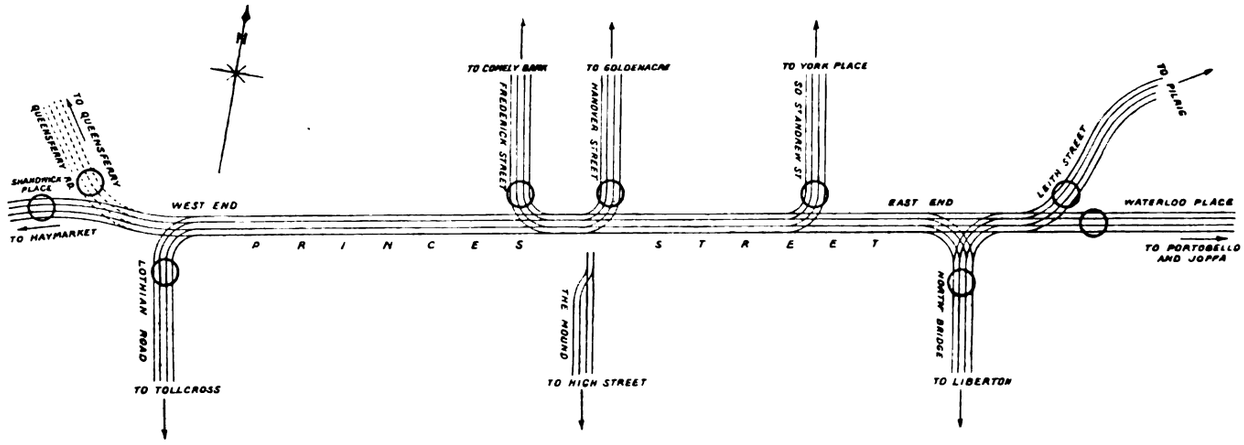

Fig. 1.—Existing and Proposed Junctions in Princes Street, Edinburgh Corporation Tramways.

Permanent way	£466,775
Buildings	173,983
Lands	29,583
Heritable properties	15,236
Electric tramways	13,267

It must be remembered in connection with the permanent way that some of the routes will last for some years before requiring renewal, whilst the heavy concrete foundations and paving setts are a valuable asset.

The power-stations and car-shed buildings, with alterations, will be suitable for the electric system, and will be capable of housing at least as many, if not more, cars than the present buildings, as well as providing for an extended workshop at Shrubhill. When these facts are appreciated, and considering that the city owns a trading concern which is capable of earning £400,000 per annum, and providing over £100,000 per annum towards interest, depreciation, and sinking fund, I do not think there should be any hesitation from a financial point of view in starting the electrification of the system. It will take several years before the whole system can be electrified. By the time the last of the cable cars stop running I believe that most of the debt of £400,000 will have been redeemed.

The construction of the Portobello electric power-station is now proceeding, and I understand that electric current for tramway purposes will likely be available within two years from this date. I would recommend the committee to obtain the necessary power for reconstruction and the building of extensions, so that contracts could be let for permanent way, cars, and alterations to buildings. The electrification of the system should proceed concurrently with the building of the power system; there would then be no time lost in providing the citizens with an improved tramway service.

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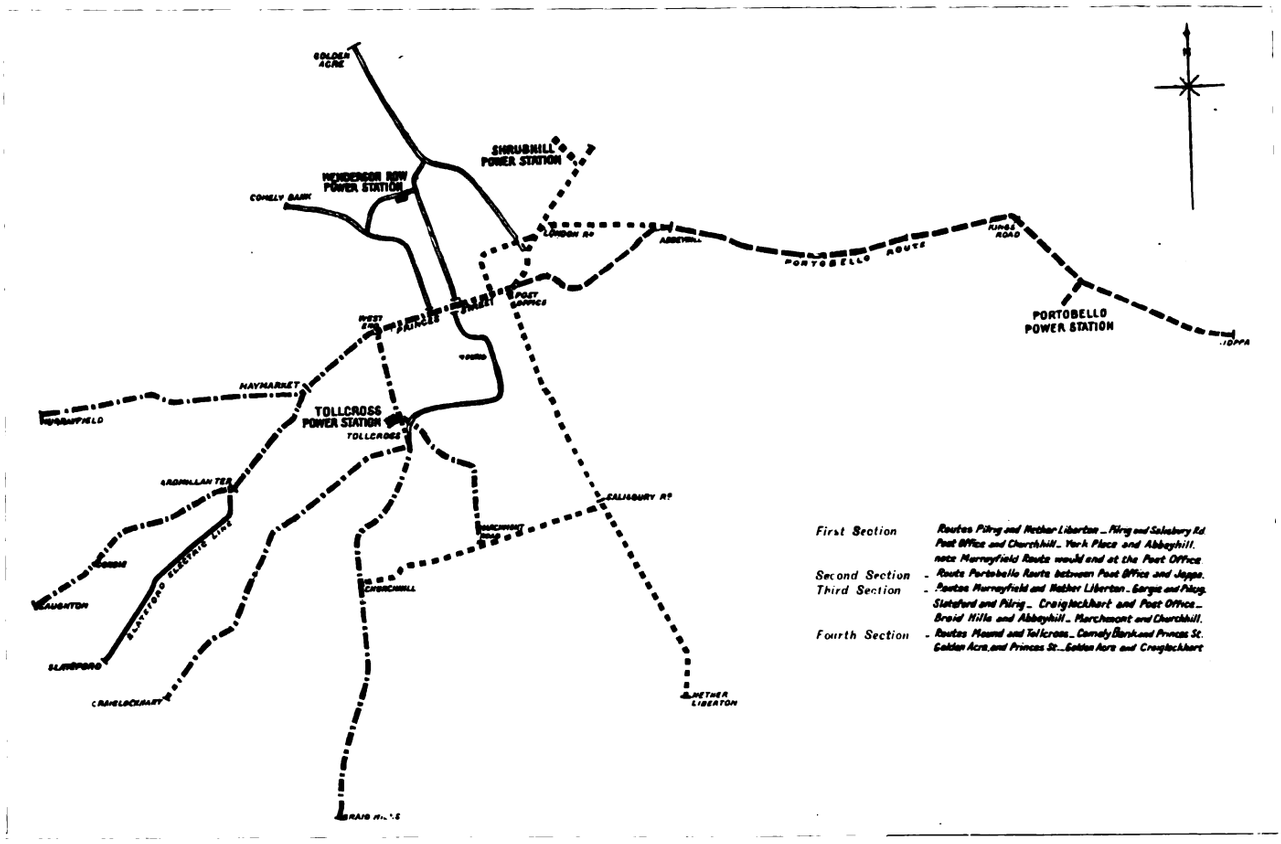
SHRUBHILL POWER STATION
HENDERSON ROW POWER STATION
TOLLCROSS POWER STATION
PORTOBELLO POWER STATION
PORTOBELLO ROUTE
First Section - Routes Piring and Nether Liberton ... Piring and Salisbury Rd Post Office and Churchhill ... York Place and Abbeyhill. note Murrayfield Route would end at the Post Office
Second Section - Route Portobello Route between Post Office and Joppa.
Third Section - Routes Murrayfield and Nether Liberton ... Gargie and Piring. Slateford and Piring ... Craiglockhart and Post Office ... Braid Hills and Abbeyhill ... Marchmont and Churchhill.
Fourth Section - Routes Mound and Tollcross ... Comely Bank and Princes St. Golden Acre and Princes St ... Golden Acre and Craiglockhart

Fig. 2.—Edinburgh Tramways showing Proposed Order of Electrification.

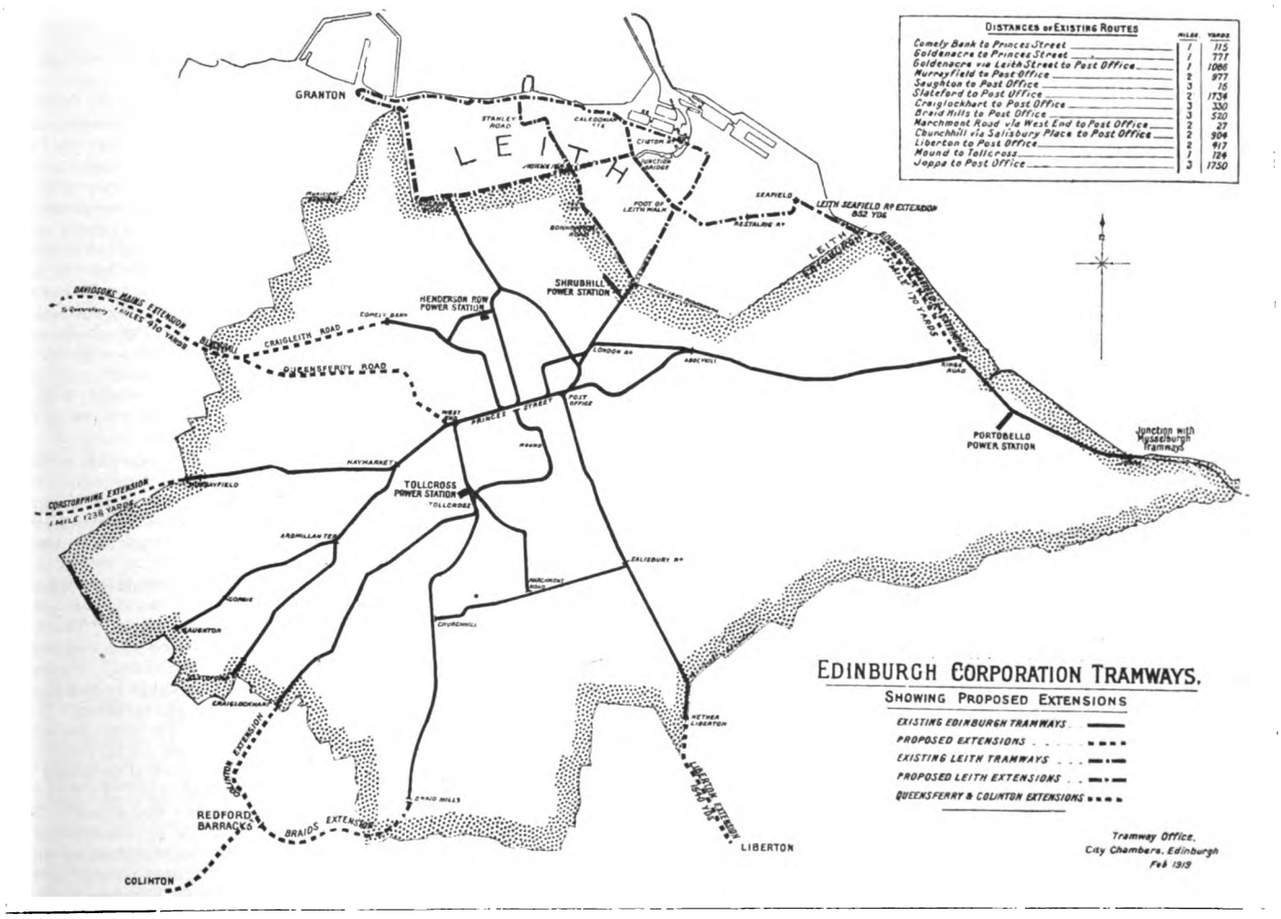
DISTANCES OF EXISTING ROUTES
Comely Bank to Princes Street 1 115
Goldenacre to Princes Street 1 777
Goldenacre via Leith Street to Post Office 1 1086
Murrayfield to Post Office 2 977
Saughton to Post Office 3 15
Slateford to Post Office 2 1734
Craiglockhart to Post Office 3 330
Braid Hills to Post Office 3 520
Marchmont Road via West End to Post Office 2 27
Churchhill via Salisbury Place to Post Office 2 904
Liberton to Post Office 2 917
Mound to Tollcross 1 124
Joppa to Post Office 3 1750
GRANTON
LEITH
SHRUBHILL POWER STATION
HENDERSON ROW POWER STATION
TOLLCROSS POWER STATION
PORTOBELLO POWER STATION
Junction with Musselburgh Tramways
REDFORDS BARRACKS
COLINTON
LIBERTON
EDINBURGH CORPORATION TRAMWAYS.
SHOWING PROPOSED EXTENSIONS
EXISTING EDINBURGH TRAMWAYS
PROPOSED EXTENSIONS
EXISTING LEITH TRAMWAYS
PROPOSED LEITH EXTENSIONS
QUEENSFERRY & COLINTON EXTENSIONS
Tramway Office, City Chambers, Edinburgh Feb 1919

Fig. 3.—Edinburgh Tramways and Proposed Extensions.

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IV.—In What Manner should Conversion and Reconstruction be Carried Out?

In considering the question of conversion of the cable system to that of the electric overhead system, the change must be carried out without stopping the traffic, and with as little dislocation of the existing routes as possible. The whole system could not be converted at once to an electric system without providing new temporary car sheds, workshops, 250 new cars, and the provision of large generating plant. Many miles of permanent way would also require renewing at once, and this work could not be done in a few months.

I have given the question careful consideration, and have come to the conclusion that the most efficient and economical way of electrifying the system would be to deal with the conversion in sections. This would enable all of the existing buildings to be utilised. It would remove the necessity of building new sheds and workshops, and it would also give sufficient time to renew the permanent way where required.

In considering the grouping of the sections to be electrified, they are naturally divided into four, to correspond with the four cable power-stations. In arranging for the different routes to be electrified it is more suitable to deal with the routes operated from one power-station, so that as each section is finished the power-stations could be shut down, and the buildings and car-sheds could then be made suitable for the accommodation of the workshop. With an electric tramway system the workshop would require to be more extensive than the existing workshop used by the Tramway Company, and as the Shrubhill depot appears to provide both a suitable site and buildings for this purpose, the first section to be dealt with would require to be the section operated from this power-station. I would therefore suggest that the first routes to be dealt with should be from Pilrig to Nether Liberton, Salisbury Place to Churchhill, and St. Andrew Street *via* York Place to Abbeyhill (Fig. 2). The extension mentioned in Section 5 of this report, from Nether Liberton to Liberton, could be built at the same time; the service of cars would run from Liberton to Post-Office, Salisbury Place to Pilrig, and Churchhill to Post Office. The section from St. Andrew Street *via* York Place to Abbeyhill would require to be temporarily run as an independent route until Princes Street is dealt with. Murrayfield route would stop at the Post Office.

The Shrubhill depot would be made suitable for both electric cars and cable cars; the north side would be used for the electric cars, and as the electric scheme increased the accommodation for cable system would decrease. A new entrance for the electric cars could be made *via* Dryden Street. As soon as the Shrubhill power-station is shut down this portion of the depot would be altered and made suitable for the main workshops for the electric cars.

The second, third, and fourth sections to be electrified are shown on Fig. 2, and the speed at which these conversions could be carried out would depend upon the time taken to convert the buildings, and the time taken to renew the permanent way. The rails would require to be bonded with copper bonds to provide for the return of the negative feeder, cables would be laid, and the overhead equipments would require to be erected, but this work would be speedily carried out and would not cause any delay.

The present condition of the permanent way is likely to cause some concern. Some of the rails are worn out and the wheel flanges are not running clear. If electrically-propelled cars are to be introduced these rails could serve only for the period of transition until the new and heavier rails could be laid down. Under such conditions the new rails could be more satisfactorily laid after the electric cars are running; this would permit of a more substantial and durable construction than is possible while the cable system is running; it would also enable the cable conduit to be removed. The great advantage of renewing the rails during the running of an electric system is that the cars can be diverted temporarily to the side of the street whilst the renewal or reconstruction work in the centre is being carried out.

The provision of rolling stock is a very important question. After all it is the condition of the cars which affects the passengers most. I believe that the most suitable car for Edinburgh would be a car to seat about sixty passengers. I am of opinion that more than this could not be efficiently handled by one conductor.

The cars should be well finished, well lighted, ventilated, and suitable for Edinburgh conditions. The seating accommodation should not be unduly crowded as it is on the present cable cars. The cars should be vestibuled for the protection of the drivers, and provided with extra entrances and exits for use during busy times. Magnetic track brakes should be provided on all cars, but on the cars which require to run on heavy gradients special mechanical track brakes should be equipped. A car to seat sixty passengers does not require to be fitted with a double bogie. A single truck with a wheel base of 7 ft. to 8 ft. would give steadiness and would traverse the curves with perfect freedom, and would run with considerably less noise than if equipped with double bogie trucks; the wear and tear on the single truck is also less, and the current consumption would be less. Undoubtedly the double truck would take the curves more smoothly, but the troubles caused by double bogies, and the disadvantages mentioned, compel me to recommend the single truck as the more suitable for city service.

The comparative shed accommodation for cable cars and electric cars at the different depots is shown as follows:—

	Cable Sheds.		Converted for Electric Cars.
Shrubhill	134	...	165
Tollcross	54	...	92
Portobello	22	...	45
Henderson Row	34	...	40
Present	244	Future	342

It will thus be seen that the existing properties can be utilised so as to be valuable assets to a new scheme of electric traction.

V.—Which Extensions and Developments should be Carried Out during the Period of Reconstruction?

The two following extensions (Fig. 3) have been authorised:—

	Route Mileage. Miles.	Yards.
Murrayfield to Corstorphine	1	1,238
Braid Hill to Redford	1	594

The Corstorphine extensions will provide great convenience, and will develop a large amount of new traffic in connection with the Murrayfield route. I would recommend that this extension be built during the period of reconstruction.

The Braids extension would provide transit facilities to the Bedford Barracks. There is no doubt that the natural extension to the barracks should be from Craiglockhart terminus, but as Parliamentary sanction has been withheld, I think in the meantime the Braids route should be deferred until further consideration can be given to the question of the proposed extensions from the Craiglockhart terminus.

Other Proposed Extensions.

Nether Liberton to Liberton route mileage, 1,540 yards.

This proposed extension is a natural one, being populated the whole of the way. Many of the people from this district walk to the Nether Liberton terminus, but use the motor omnibus when there is accommodation. This extension is very necessary, and would be much appreciated in this district. It would also help to open up building operations for what is a beautiful and desirable site for a Garden City scheme. I would suggest to the committee the desirability of obtaining the necessary powers for the construction of this extension.

King's Road, Portobello, to Seafield Road (at Edinburgh and Leith boundary) route mileage, 1 mile 157 yards.

In connection with the above proposed extension, it might be necessary for the Leith Corporation to build the tramway along Seafield Road and to connect up with their existing line to Pilrig.

The extension of the Burgh of Leith would be 852 yards, making the new tramway 1 mile 1,009 yards. At the present time the passengers in North Edinburgh and Leith who desire to proceed to Portobello have to travel *via* Waterloo Place. A great many people residing in Leith travel by the Leith car to Seafield terminus, and then walk along the Seafield Road to Portobello. It is an undoubted fact that there would be a large tramway traffic between the industrial populations of Leith and Portobello during the summer months. This extension is required to relieve the Portobello route, which is already overcrowded at holiday times, and with greater facilities in the future the traffic will become heavier. In these circumstances I believe the proposed extensions would not only develop new traffic to Portobello, but would greatly relieve at busy times the traffic to Portobello *via* Waterloo Place.

Mutual running arrangements would require to be made with the Leith Corporation which would enable through passengers being conveyed from Stanley Road, Leith, to Joppa. I would recommend the construction of this line during the period of reconstruction.

Comely Bank to Davidson's Mains route mileage, 2 miles 410 yards.

The proposed extension from Comely Bank terminus along the Craigleith Road to the junction of Queensferry Road is a natural and necessary extension of the Comely Bank route. There are houses practically all the way. This thoroughfare and this section of the city should be provided with transit facilities. From the junction of Craigleith Road and Queensferry Road it is but a short distance to Blackhall, and still further on there is Davidson's Mains.

These villages, although situated outside the city boundary, are practically suburbs of Edinburgh, and have an intimate connection with the city. I believe this district would, if provided with proper facilities, develop a large traffic to and from the city, and would be a useful and profitable extension to the Comely Bank route. If and when the Queensferry tramway is constructed the villages of Blackhall and Davisdon's Mains would naturally receive facilities from that route. The Comely Bank cars would, in these circumstances, stop at the junction of Craigleith Road and Queensferry Road. I beg to recommend that power be obtained for the construction of this extension.

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QUEENSFERRY TRAMWAY.

The Corporation have already agreed to apply for powers to construct an electric tramway system from the city to Queensferry *via* the Dean Bridge, so that it is unnecessary for me to deal with this proposed extension here.

AUXILIARY ROUTE TO PRINCES STREET.

I wish to draw the committee's attention to the consideration of auxiliary routes to Princes Street. In connection with the Princes Street tramway, in another part of the report I suggest that if an electric conduit system is constructed in Princes Street that an auxiliary track should be laid along George Street on the overhead system, in order to provide against breakdowns on the Princes Street section. Outside of the question of the particular form of construction for Princes Street, an auxiliary route to Princes Street is worthy of consideration now in view of the amount of traffic which will develop in the future. An additional connection between the east and west of Edinburgh could be made either by way of York Place, Queen Street, Glenfinlas Street, and Hope Street to the West End, or by way of York Place, St. Andrew Square, George Street, and South Charlotte Street to West End.

I believe that if the alternative cars of certain West End routes were to be diverted along either of the suggested routes, there would be a slight gain in time, but this would be nullified to some extent on the Queen Street route owing to the gradient in Glenfinlas Street.

Of the two routes the George Street route appears to have the greater advantage. George Street is very largely a shopping street, and would have a heavier tramway traffic than Queen Street, and, being so much nearer Princes Street, would be more effectual as an auxiliary route. If the George Street line were constructed, a convenient route might be run from Comely Bank *via* George Street, St. Andrew Square, and, if necessary, could be connected up with Princes Street. The Goldenacre cars could proceed *via* George Street and South Charlotte Street to the West End. The George Street line would have the advantage of forming a connection with the Comely Bank and Goldenacre routes at the top of the hill, whereas the Queen Street line would require to be joined with the two northern routes on a heavy gradient, which is a distinct disadvantage.

Of the two auxiliary routes considered, I would certainly prefer the route along George Street, but this question very largely depends upon the policy adopted by the Corporation with regard to Princes Street, so that in the meantime I do not intend to make any recommendations with reference to an auxiliary route.

DEVELOPMENTS.

In addition to the particular extensions mentioned, which are urgently required, there are other districts adjacent to Edinburgh which require improved transit facilities with the city. These districts, which include Dalkeith, Lasswade, Penicuik, and Gorebridge, also Colinton and Juniper Green, should be connected up with the city system, and now that the Government realise the importance of cheap electric power and improved transit facilities, there are good prospects for the future development of the transit facilities between the suburban districts and the city of Edinburgh.

The conversion of the system will open the way for other developments, but I have deemed it desirable to leave over consideration of these meantime.

MOTOR OMNIBUSES.

The motor omnibus traffic passing into the city of Edinburgh is extensive, and in the future it is likely to develop considerably. In connection with the development of the City's tramways service, it becomes increasingly evident that the motor omnibus will be required in some districts to develop the traffic prior to the laying of the tramway lines, and in some cases to run services in conjunction with the tramway system. The question of motor omnibus services running through the city of Edinburgh is intimately connected with the future transit problems of the city, and it appears to me that it is desirable for the city to obtain Parliamentary powers to operate motor omnibuses in conjunction with their tramway system outside the city boundaries. This power has been obtained in other towns where motor omnibuses are being operated by the Corporation tramway system, among which may be mentioned the following:—

Powers.

Sheffield ... Running powers for eight routes as far as six miles beyond the city boundary.

Walsall ... Running powers for five routes running as far as six-and-a-half miles beyond city boundary.

The extensions to the tramway system which are proposed cannot be constructed at the earliest for two years; in the meantime these extensions could be temporarily operated by motor omnibuses. There are other routes on which motor omnibuses might be run to advantage, but consideration of these can be taken up later.

The Corporation already have obtained Parliamentary sanction to operate motor omnibuses within the city, and in fact did institute a service of motor omnibuses during the early months of the war, but owing to the fact that the omnibuses were not under direct control, and that the scope and routes of the omnibuses were strictly limited by agreement with the tramway company, there was little chance for them to have proved a success.

With the Corporation operating their own system, the position is entirely changed. There will be a distinct scope and promising field for the operation of motor vehicles. In addition to the temporary services over proposed extensions, motor omnibuses would be useful to supplement the existing services at certain points; they would also be useful in cases of breakdown of portions of the cable system, and for special purposes.

With these objects in view, I would ask the committee to consider the advisability of at once acquiring some motor omnibuses.

VI.—SUMMARY OF RECOMMENDATIONS.

(1) That the cable system should be discontinued.
(2) That the system should be electrified, and that the overhead electric system should be adopted.
(3) That Princes Street should be specially treated by placing the tramway on the south side of the street, with side pole overhead construction.
(4) That preparations for conversion and reconstruction should be made at once.
(5) That conversion and reconstruction be carried out in sections as indicated.
(6) That powers be obtained for the construction of the extensions recommended.
(7) That a number of motor omnibuses should be acquired as soon as possible, and that Parliamentary powers should be obtained for operating motor omnibuses in conjunction with the tramway system outside the city boundaries.

In reporting to the committee on the question of the reconstruction and development of the system, I have, whilst going into many details, avoided detailed estimates, and have endeavoured to deal with the subject in a general way. I think it is desirable that the Council should declare its future policy as soon as possible. Detailed estimates can then be prepared for permanent way, alterations to buildings, provision of new cars, etc.

MANUAL OF ELECTRICAL UNDERTAKINGS.*

Again we have the invaluable and indispensable "Garcke" with us, bigger and more useful, if possible, than ever. The introductory matter to this year's volume, as usual, contains a mass of general information brought well up to date except in those cases where circumstances arising out of the war have prevented the issue of statistics. In these instances the latest available figures are recorded, along with the comparisons with previous years. The introductory articles in this and the previous annual volumes form a valuable record in the history of British electrical industries, and the list which is given of these articles, including surveys of the year, becomes longer and more useful as time goes on. In view of the promised legislation for the establishment of a national electric power supply in this country, readers will find much convenience from the fact that the reports of the Coal Conservation Committee and the Electric Power Supply Committee which were published last year are included in the volume. It is on these reports, with their proposals for a Board of Electricity Commissioners and District Electricity Boards, that the forthcoming legislation will be based. Hence the value of having the reports in handy form for reference.

As to the general scope of the book this year, it contains statistical and general information relating to about 3,000 electrical undertakings in the United Kingdom and in British possessions abroad. The aggregate capital issued by electrical companies registered in Great Britain, together with the amounts borrowed by municipalities for electrical undertakings (but excluding the capital for Government telegraphs) was last year £489,101,584, which is an advance of nearly fourteen millions on the preceding year. The first volume of the "Manual," published in 1896, contained particulars of 200 undertakings, with a capital of £61,109,525. The statistical tables of financial results, etc., are as usual full and elaborate. One or two items in regard to traction undertakings may be quoted. The total capital issued by electric tramway and railway companies is at present £189,576,073, and the figure is a steadily increasing one from year to year. The amount of capital expenditure by municipalities on electric traction is £53,800,606. The amount has not advanced much during the last four years.

The bulk of the book is, of course, taken up with the particulars of each individual undertaking, and the sectional and alphabetical orders make reference most convenient. A feature of the book has always been its maps, and on this occasion there are over 50 of these, showing the principal tramway and electric railway systems and power undertakings of the United Kingdom and the Dominions. The national electric power proposals now in the air give special interest to the maps of existing power distribution undertakings. The directory of officials, which forms a valuable feature of the work, now embraces about 20,000 addresses. Another section relates to electrical contractors.

* Manual of Electrical Undertakings and Directory of Officials, 1918-19. Compiled under the direction of Emile Garcke, M.I.E.E. Vol. XXII. London: Electrical Press, Limited. 1,715 pp., 22s. 6d. net.

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LONDON TRAMWAY EXTENSIONS.

NEW AND LINKING UP LINES IN AND NEAR THE CITY.

The London County Council on February 18 approved the recommendation of the Highways Committee that Parliamentary powers should be sought in the present session of Parliament for the linking up and extension of the tramways. All the extensions proposed were contained in a scheme submitted in 1914. The lines are urgently required, and the Committee recommended that they should be proceeded with at the earliest possible moment. In spite of the high cost of the work under present conditions, each of the proposals will be of immediate financial benefit to the undertaking. In only two cases will the work involve street widenings. Three of the proposals are for linking up or abolishing dead ends, two being complementary to each other for the purpose of linking up the southern tramways at Blackfriars Bridge with certain routes on the northern system. The need for satisfactory connections allowing the passage of double-deck cars between the northern and southern systems is well understood. The remaining three proposals provide for the extension of existing central terminals nearer to large traffic centres. The following list gives particulars of the six lines proposed :—

Description of Tramway.	Length (Single Line).	Estimated Capital Cost.
	m. f. c.	£
(1) Charles Street to Blackfriars Bridge *via* Farringdon Road, Farringdon Street, and New Bridge Street	1 3 1	83,490
(2) Gray's Inn Road to Farringdon Street *via* Holborn and Charterhouse Street	0 5 6	50,700
(3) Aldgate terminus to Aldgate Station *via* Aldgate High Street	0 1 1	22,490
(4) Hampstead Road to Oxford Street *via* Tottenham Court Road	1 2 7	79,760
(5) Seven Sisters Road to Stamford Hill *via* Amhurst Park ...	1 2 6	52,160
(6) Southampton Row to New Oxford Street *via* Vernon Place and Hart Street	0 3 6	30,890
	5 2 7	£319,490

(1) Charles Street to Blackfriars Bridge *via* Farringdon Road, Farringdon Street, and New Bridge Street. Length of tramway, about 5 furlongs 5 chains of double line. Estimated cost of construction and equipment on the underground conduit system of traction, £83,490. This proposal, in conjunction with the next, was submitted to the Council in a slightly different form on November 10, 1914. The construction of this tramway would afford a connection between districts north and south of the Thames by double-deck cars, and would be of the utmost importance. The present dead end in Farringdon Road would be removed, and direct services run to Ludgate Circus from Islington, King's Cross, Highbury, and Highgate on the northern and from almost every point on the southern system. The line would prove of great benefit to large numbers of passengers travelling to and from the important business centres round Fleet Street and St. Paul's Churchyard. The present congestion at Blackfriars would also be relieved by passengers being conveyed direct from their places of work instead of being concentrated at one point. The Council already has power to construct a junction between the tracks in Farringdon Road and Clerkenwell Road ; and this junction will greatly increase the utility of the proposed connection between the northern and southern systems.

(2) Gray's Inn Road to Farringdon Street *via* Holborn and Charterhouse Street. Length of tramway, about 2 furlongs 3 chains of double line. Estimated cost of construction and equipment on the underground system of traction, £50,700. This proposal, in conjunction with the previous one, was submitted to the Council in a slightly modified form on November 10, 1914. It will provide another connection between the tramways north and south of the Thames. The present dead end at the junction of Gray's Inn Road and Holborn will be abolished, and it will be possible to run cars from Gray's Inn Road along Holborn and Charterhouse Street and north *via* Farringdon Road and *vice-versa*. It will also enable services to be operated direct to Holborn Circus, and provide access by tramway to the important shopping district between Holborn Circus and Gray's Inn Road.

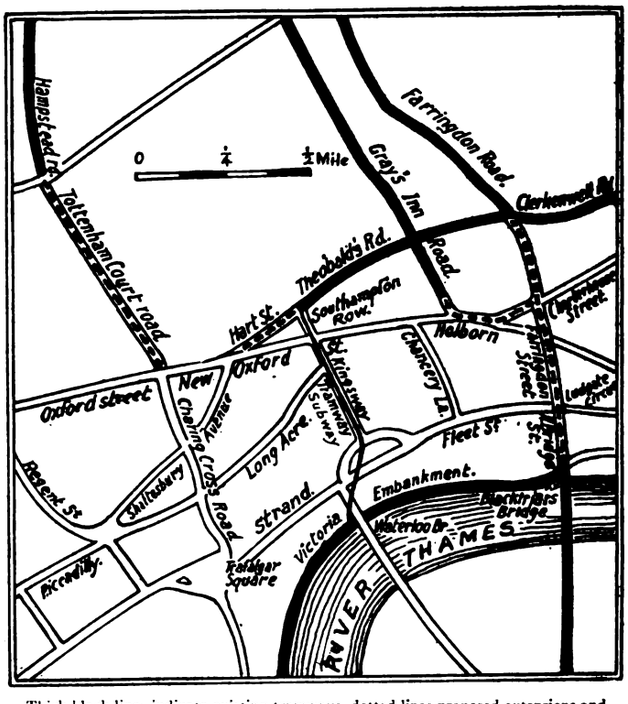
(3) Aldgate terminus to Aldgate Station *via* Aldgate High Street. Length of tramway, about 5 chains of double line and 1½ chains of single line. Estimated cost of construction and equipment on the underground conduit system of traction, £22,490. This proposal was one of those submitted to the Council on November 10, 1914. Although only a short extension, this tramway would be of great service in conveying passengers nearer to the heart of the city than is the case at present. Serious delay is caused at the present terminus by the Whitechapel hay market, and the free access of passengers to and from the footways is obstructed by costers' barrows.

(4) Hampstead Road to Oxford Street *via* Tottenham Court Road. Length of tramway, about 5 furlongs 3½ chains of double line. Estimated cost of construction and equipment on the underground conduit system of traction, £79,760. It is highly important that tramway passengers should be brought nearer to the real traffic centres than is now possible. Tramway passengers desiring to reach points in Tottenham Court Road have at present, in some cases, to walk considerable distances. The proposed tramway should also create new traffic to and from the terminus at Oxford Street.

(5) Seven Sisters Road to Stamford Hill *via* Amhurst Park. Length of tramway, about 6 chains of double line on the underground conduit system of traction, and 4 furlongs 7 chains of double line on the overhead system. Estimated cost of construction and equipment, £52,160. This proposal was one of those submitted to the Council on November 10, 1914. This tramway would connect the existing terminus at Stamford Hill with Manor House and Finsbury Park, and provide direct tramway facilities between the districts of Hackney and Clapton and those of Finsbury Park, Holloway, and Camden Town. The present tramway service between Mile End and Stamford Hill is handicapped in consequence of the parallel omnibus service running through Amhurst Park to Finsbury Park Station.

(6) Southampton Row to New Oxford Street *via* Vernon Place and Hart Street. Length of tramway, about 1 furlong 8 chains of double line. Estimated cost of construction and equipment on the underground conduit system of traction, £30,890. The present terminus at Theobalds Road, which is a dead end terminus for double-deck cars, is very congested at busy hours, and delay is caused to the subway cars which run through to Charing Cross and Westminster. The proposed new tramway would reduce the amount of obstruction, and provide new facilities for passengers desiring to reach the important traffic centre of New Oxford Street.

The total length in single line of the proposed tramways is about 5¼ miles, and the total estimated cost of construction and equipping the tramways is £319,490. The estimates given do not include the cost of the provision of cars, car sheds, sub-stations, and other



Thick black lines indicate existing tramways, dotted lines proposed extensions and linking-up lines. The subway connection between Theobald's Road and the Victoria Embankment is shown by a thin black line.

Map of proposed London Tramway Extensions.

equipment, and sites for such buildings, as expenditure on these heads is common to more than one route. The existing car sheds and sub-stations will be utilised.

In only two cases, those of the proposed tramways from Gray's Inn Road to Farringdon Street and from Southampton Row to New Oxford Street, will it be necessary for any widenings to be effected, and the Highways Committee have accordingly communicated with the Improvements Committee with regard to these two proposals, in order that they may submit any necessary recommendations as to such widenings. The estimates above given do not include any portion of the cost of the widenings which may hereafter be allocated to the tramways account.

The proposed new lines in their relation to the present tramway system is shown on the accompanying map. On all the lines with the exception of No. 5 in the list, the line from Seven Sisters Road to Stamford Hill *via* Amhurst Park, the underground conduit system will be used.

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The Finance Committee concurred in the proposal to apply for powers for the proposed lines, and in their report stated that the total cost of the extensions, including the proportion of street widenings chargeable to the tramway account, would be £440,190. While the new expenditure for construction and equipment (£418,215) is very high, owing to the present conditions, each scheme is estimated to show a surplus on working. The report alludes to the difficulty of estimating financial results, for not only are receipts and working expenses abnormally high at present, but it is difficult to estimate exactly the capital cost of the tramways. The figures upon which the estimates have been based are approximately 100 per cent. above pre-war prices. The debt charges will consequently entail a very heavy burden on revenue, and will require a larger margin of revenue over working expenses than under pre-war conditions.

THE LONDON UNDERGROUND RAILWAYS.

AN INTERESTING SITUATION.

More than ordinary interest attaches to the directors' reports and the accounts recently issued for the year 1918 of the railways and the big omnibus undertaking associated with the Underground Electric Railways Company of London. In spite of high prices for everything and of scarcity of labour, the associated companies distribute higher dividends than for a long time past, and most of them have produced more gratifying returns than at any time in their previous history. The two main reasons which have enabled them to hold their own under wartime conditions may be said to be the ever-growing volume of traffic, and in some cases an increase in fares. The results are certainly gratifying and are highly creditable to the management, the engineers, and all the staff, but still the dividends for the railway shareholders are not much to boast about in these days of 5 per cent. Government securities. In considering that feature, however, it has to be borne in mind that the railway capitalisation is necessarily very heavy. The London General Omnibus Company is the member of the group which is not penalised by the cost of constructing tunnels and permanent way, and its dividend is higher. The following is a summary, with explanation and comment, of the records of each of the companies:—

Metropolitan District Railway.

This line may be called the "father" in the group; as a steam railway it goes back to quite a hoary antiquity, but its latest days are proving its best, not its worst. In its steam days it was financially in a lamentable condition, and people only travelled in its sulphur-laden tunnels because they could not help it. Electrification, brought about in 1905, also brought about a revolution in comfort, speed, and finance. A gradual improvement in dividends has gone on, and though the holders of the ordinary stock still receive no return, that stock is less than a third of the total, or, including debenture capital, it is only about a fourth. The total capital is over 13½ millions sterling, and the length of route worked is about 40 miles. This, however, includes a certain length of "foreign" lines worked over and lines partly owned.

The District Railway, unlike the "tube" lines with which it is associated, has been under Government control since the beginning of the war, as it has physical junctions which connect it with the main lines of the country. The accounts are presented in that skeleton form to which we have grown accustomed since the control began. Much information which would be of interest is accordingly not available. Obscurity is increased by the fact that the receipts from working are under not only the terms of the control agreement with the Government, but are also under the terms of the Common Fund agreement of December, 1915, to which further reference is made below. The receipts so arrived at amount for the past year to £1,307,439, compared with £1,122,068 in 1917. The working expenses were £865,427. After bringing in miscellaneous receipts, there is a net income of £583,703, against £568,274, and £565,765 in 1916. After allowing for fixed charges, appropriation to reserve (£35,000), and dividends on guaranteed and first preference stocks, there remains a balance of £104,831. The corresponding balance a year ago was £83,129, and for 1916 it was £71,788. The dividend on the second preference stock is 5 per cent., which is the full rate for the stock, £10,000 more goes to reserve, and £21,331 is carried forward. This is the first time that the second preference stock has received its full dividend. It is not so many years since it received nothing, and when it began to get a little there was a pæan of triumph over this result of electrification of the line. The distribution steadily crept up from 1 per cent. in 1911 to 3 per cent. in 1915, at which it remained till for 1918 the full 5 per cent. has been paid. There is nothing between the second preference stock and the ordinary stock, so that the holders of the latter, if conditions continue to improve, may yet receive a dividend. The reserve fund now stands at £330,528.

The number of passengers during the year is not stated for the District Railway, nor for any of the other undertakings separately, but the aggregate for the five companies is put by way of an estimate at 901,000,000. Reference is made in the various reports to the troubles in working owing to shortage of staff and the difficulty of obtaining materials. A very marked feature on the District Railway has been the enormous amount of military traffic owing to the fact that the railway links up several of the main line termini.

The causes of the overcrowding of the trains which has occasioned much inconvenience to the public are beyond control, as they arise mainly from shortage of rolling stock and insufficient staff. The engineering department, it is no secret, has done wonders with the means at its disposal, and has contrived to maintain a splendid service with an extraordinarily small margin of spare cars in the repair shops. Arrangements are in hand, and now that the war is over there is some prospect of their being carried out, for the provision of additional and improved rolling stock, and employees are now beginning to get back from military service.

It is only on the longer journeys on the District Railway, or on those outside an inner zone, that the 50 per cent. increase of fares applies. In the central regions the fares were low, and during the year they have been revised so as better to meet the heavy charges

The Common Fund.

The Common Fund agreement of the five companies was entered into in 1915 for the purpose of mutual assistance. It does not appear from the accounts that any of the five companies have drawn on the fund for anything but their fixed proportions. The aggregate gross receipts of the companies from all sources were £7,743,451. The amount retained by them for revenue liabilities as defined in the agreement, which include working expenses, prior charges, reserves, and other items of a similar nature, was £7,111,760. The balance of £631,690 was credited to the Common Fund. Under the terms of the agreement the District Company is entitled to 12 per cent. of the fund. It accordingly received £75,803 for the year. This sum, plus £29,028 brought forward, makes a total of £104,831, which is available for dividend on the second preference stock and further reserve. This also is the sum brought out in the accounts which are summarised above. The explanation of the identity of the two sums is, we understand, to be found in the heading in the accounts giving the receipts from working the railway. This runs—"Receipts in respect of railway working under the terms of the agreement with the Government in respect of the control of railways and the terms of the agreement of December 21, 1915, referred to in the report of the directors, £1,307,439." The point lies in the words, "the terms of the agreement of December 21, 1915." This is the Common Fund agreement. The working expenses, fixed charges, and so forth stated in the accounts are absolute sums. The receipts from working the railway, on the other hand, are subject to adjustment, not only under the Government control agreement but under the Common Fund agreement. It is because of the requirements of the latter that the receipts are of such an amount that when all deductions and allowances are made the net balance corresponds to the proportion of the Common Fund to which the railway company are entitled. The same arrangement applies in the case of the affiliated tube railway companies and the London General Omnibus Company.

London Electric Railway.

This company, and the Central London and the City and South London, unlike the District Company, are not under Government control, but the accounts are set out in similar form. This is done, it is stated, to save paper and labour. What is called the London Electric Railway, as is well known, consists of three separate lines, the Baker Street and Waterloo Railway, the Charing Cross, Euston and Hampstead Railway, and the Great Northern, Piccadilly and Brompton Railway. These have an aggregate route length of about 25 miles, almost entirely constructed in twin tubular tunnels at a deep level. The capital issued, including debenture stock, is in round figures 17½ millions, indicating the expensive nature of the construction.

The receipts from working the railway last year were £1,325,628, as compared with £1,139,554 in 1917. The working expenses amounted to £769,677, against £611,892. After bringing in miscellaneous receipts, there is a net income of £650,604, compared with £616,989, and with £500,190 in 1916. A balance forward of £30,656 being added, fixed charges and preference stock dividend being deducted, and £35,000 being appropriated to reserve, there remains £220,163 available for dividend on ordinary shares and further reserve, compared with £180,575, and £164,383 in 1916. The dividend on the ordinary shares is 2 per cent., being the highest on record, a further £10,000 goes to reserve and £23,604 is carried forward. The reserve now stands at £251,000. The highest previous dividend was 1½ per cent., which was paid for 1917 and 1916. For several years it was only 1 per cent., and before that it was less. The company's share of the Common Fund (30 per cent.) is with the balance forward equal to the £220,163 mentioned above.

Despite the difficulties arising out of the war, the traffic carried during 1918 constituted a record for any year since the line was opened. Arrangements have been made to obtain delivery at the earliest possible moment of additional rolling stock, some of which was ordered in 1914. It is proposed to proceed at an early date with improvements which were postponed on the outbreak of hostilities, and additional capital will be required. An arrangement

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has been made between the company and the City and South London and Central London Companies, whereby the London Electric Railway Company bears all the expense of maintaining and operating the three railways, receiving advances of money from time to time as necessary. At the close of each year the expenses are allocated on an agreed statistical basis. By this combined operation considerable economies are being effected.

Central London Railway.

From the point of view of rate of dividends to shareholders the Central London has from the first been the most successful of the "tube" railways. Practically from its earliest days it made a return of 4 per cent. on the ordinary stock. This arose from the fact that it occupies throughout its length one of the greatest lines of passenger movement in London. The development of the motor omnibus, however, affected it considerably, as great numbers of omnibuses run on the street for miles immediately above the railway. Largely on this account the old system of a uniform fare of 2d. for any distance on the railway was superseded by a scheme of fares graded in proportion to distance, so that short-journey traffic might be encouraged. In the days when a passenger could travel from one end of the line to the other—then a distance of less than six miles—the appellation of "the twopenny tube" was appropriate enough. Since then the railway has been somewhat extended both to the east and west, so that it is now about 6½ miles long, and a further extension westward from Shepherd's Bush to Ealing is likely soon to be carried out. The issued capital, including debenture stock, amounts to £4,556,000.

For the past year the revenue from working the railway was £422,183, as compared with £351,289 in 1917. The working expenses were £238,826, against £192,465. Adding miscellaneous receipts, there is a total net income of £227,571, against £196,208. Deducting fixed charges, appropriation to reserve (£20,000), and preference stock dividend, there remains available for dividends on ordinary stocks £137,485, compared with £116,147 and £117,079 in 1916. The dividend is 4 per cent. on the ordinary stocks, and £17,485 is carried forward. The reserve fund stands at £149,141. A year ago, while the preferred ordinary stock got 4 per cent., the allocation to the ordinary was 3½, and to the deferred ordinary 3. The Central London also had a bigger traffic than in any other year of its existence. The Company's share of the Common Fund is 20 per cent.

City and South London Railway.

This, the oldest of the "tubes," also did well during last year. The original section, about three miles long, from the City to Stockwell, was the first railway of the kind ever constructed, and came into operation in 1890. The tunnels are smaller in diameter than those of the other tube railways, and consequently the accommodation in the cars is somewhat cramped. It is the only one of these railways which uses separate electric locomotives to haul the trains, and the latter are consequently light in weight. Years ago an experimental car with the motors underneath it was constructed with the object of finding if it was possible, with such limited space available, to use the multiple-unit train system employed on the other lines, but if possible it has not been adopted in practice. In such small tunnels there are advantages in having separate locomotives, and the latter are not of sufficient weight to cause the vibration which led to the abandonment of separate locomotives on the Central London Railway some years ago.

Including the extensions made from time to time, the railway is 7¼ miles long, but it has not such a large traffic in proportion to length as some of the other tubes. On the other hand, its capitalisation per mile is somewhat less, the tunnels and many of the stations being smaller. The capital issued, including debenture stock, is £3,424,000.

For the past year the revenue from working was £309,315, as compared with £258,233 in 1917. The working expenses were £180,812, against £141,185. Adding miscellaneous receipts, there is a total net revenue of £152,405, against £142,323. Deducting fixed charges, preference stocks dividends, and appropriation to reserve (£25,000), there remains available for dividend on the ordinary stock £59,167, against £48,466 for the preceding year, and £30,445 in 1916. The dividend on the ordinary stock is 2 per cent., £5,000 more goes to reserve, and £24,567 is carried forward. The ordinary stock dividend for 1917 was 1½ per cent., and round about that figure or less it has hovered for a long time. The reserve now stands at £91,000. The City and South London's share of the Common Fund is only 6 per cent., and this with £21,266 brought forward amounts to the £59,167 already mentioned.

As in the case of the other tube railways, the traffic for the year was the greatest on record. Arrangements are in hand for the purchase of new and larger cars, and the work of enlarging the tunnels, which was suspended on the outbreak of the war, will shortly be recommenced. For the purpose additional capital will be required.

London General Omnibus Company.

Having dealt with the various railways, we come to that interesting and remarkable partner of a railway company, the London General Omnibus Company. As is well known, it owns the great bulk of the omnibuses which run in London and the surrounding districts. Unlike the railways, it had no need to spend any capital in constructing its road, and it has practically nothing to pay towards maintaining it. It is accordingly not surprising to find that a good dividend is paid. Were it not for the fact that the percentage of expenses to receipts in working petrol omnibuses is very high compared with the corresponding percentage in the case of an electric railway, a motor omnibus company would be able to pay very large dividends. The London General Company suffered very severely during the war, as not only had it the same troubles as the railways in consequence of scarcity and the high cost of labour and materials, but many of its vehicles were taken away for war service on the Continent. Hence both lower revenue and an intolerable overcrowding of the omnibuses. For a long time thay have not been able during the rush hours to carry anything like the traffic offering.

The issued capital, including debenture stock, is £3,524,000. The gross receipts for last year came to £3,979,799, against £3,401,708 for 1917, and the working expenses were £3,456,244, compared with £2,088,209. An allowance of £22,629 is made for depreciation, and £285,000 is carried to reserve, which now stands at no less than £1,904,869. After crediting interest on investments and debiting fixed charges, a net balance is left of £240,688, against £187,926. The company receives no less than 32 per cent. of the Common Fund, and that amount, along with a balance forward of £38,547, comes to the £240,688 mentioned above. A dividend of 8 per cent. is paid, and £60,930 remains which is carried forward. A year ago the dividend was 7 per cent.

The dividend is equal to that which used to be paid in the old horse omnibus days, before all the expense and work of developing the motor vehicle began. It may be remembered that in the earlier years of the latter the company was in a comparatively non-prosperous condition. It will also be observed that even after appropriating a very large sum for depreciation and reserve, the company's large share of the Common Fund enables it to pay a handsome dividend.

In the ordinary way the working "life" of a motor omnibus is not very long, so that a good reserve and depreciation allowance are necessary. Then during the war maintenance could not be fully carried out. The wisdom of accumulating a large depreciation and reserve fund is obvious. The need for the fund is emphasised by the statement of the directors in their report that the fleet of omnibuses has now reached such a state as to require complete renewal.

At the annual meetings of the companies held during February no definite forecast as to the future was made by the chairmen. Conditions as to labour and cost of materials are too uncertain. Some of the chairmen mentioned that further increases of fares will be necessary, and this is not surprising as regards lines which have not participated in the 50 per cent. increase applied to the railways of the country generally. Lord Farrer, who presided at the meeting of the London Electric Railway Company, stated that, as the price of material and labour was so high, only vitally important works could be undertaken with any hope of securing an adequate return on the capital expenditure. As regards the omnibus company, a considerable number of additional vehicles were put on the streets in the end of February; this course was rendered possible by the return of drivers from the army.

The Lots Road Power Station.

Mr. Z. E. Knapp, manager for maintenance and construction of the underground railways, issued a statement in February in connection with the subject of overcrowding, in which he recapitulated the well-known causes. The most interesting part, however, was the information he conveyed in regard to the Chelsea power station from which the railways are worked. He said that compared with the end of 1914 the load on this station shows an increase of 17 to 18 per cent. The greatest difficulty is in regard to the coal supply, and this difficulty has been increasing since 1915, when it was first necessary to burn a percentage of inferior coal mixed with the usual supply. This inferior coal is poor in steam-raising qualities and contains an abnormal amount of ash and clinker. One result of having to handle and burn a type of coal for which the plant was not designed is to accentuate the labour difficulty. More labour is required to handle the coal; the number of boilers must be increased and the number of attendants also; an extra strain is put on the stoking and ash-handling plants, involving increased maintenance. Moreover, the general restrictions on coal consumption are being severely felt at Lots Road power house. Just before the war a 15,000 kw. turbine was obtained; and this was put into commission in 1915. The results were so good and the saving in coal so large that arrangements were put in hand to instal a second one of the same size. Incidentally this would have saved some thousands of tons of coal, but a permit could not be obtained, and the project had to be abandoned. The permit has now been received and contracts placed for the second set.

Underground Railways Company.

The report of the Underground Electric Railways Company of London also makes a comparatively good showing. This company, it will be remembered, carried out the electrical equipment of the District Railway, constructed and equipped the tube lines now owned by the London Electric Railway Company, and built the Chelsea power-station, taking payment to a large extent in shares

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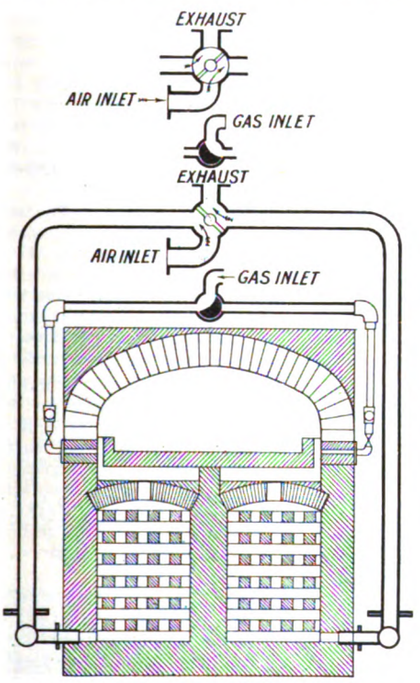
or stock of the associated undertakings. After the initial work was finished, the railways took over the operation of the power-station, and the Underground Electric Railways Company became simply a holding company, receiving its revenue in the shape of dividends on the stocks and shares held. The issued capital is, in round figures, 15 millions, of which one-third is in shares and the rest in bonds and debentures. This is balanced by the holding of stocks and shares in the other companies valued at over 14½ millions. A certain amount of shares in the London and Suburban Traction Company, the Associated Equipment Company, and other undertakings is included. The income from the investments for the past year was £760,265, as compared with £606,730 for 1917. After meeting prior charges, interest at 5 per cent. is paid on the 6 per cent. 1948 income bonds, and £36,693 remains, which is carried forward. A year ago the interest paid on these bonds was 4 per cent. The ordinary shares are not within sight of a dividend.

THE DAVIES "REVERGEN" GAS-FIRED FURNACE.

The possibilities of fuel saving in the use of town's gas-fired furnaces was clearly demonstrated to a number of Press representatives on the 18th, 19th, and 20th of February by the Davis Furnace Company, at their works at Luton. Some remarkable results were achieved, and in view of the high cost of labour with which manufacturers will be faced in the future, not the least interesting feature of the "Revergen" system of furnace heating is the little attention required in its working. Briefly stated, the "Revergen" furnace is so constructed that the heat losses by way of the flues are reduced to a minimum, the thermal energy thus recovered being utilised almost exclusively for the practical purposes of the furnace. It follows, therefore, that a much larger proportion of the total heat latent in the gas consumed in firing is utilised in the generation of the desired working temperature by furnaces fired upon this principle



Davis "Revergen" Gas-Fired Oven.
(54 in. × 32 in. × 24 in.).

than in the case of any of the older systems. Apart from the possibility of maintaining a given temperature with a greatly reduced gas consumption, much higher temperatures are rendered economically attainable, while the precise accuracy of temperature control was demonstrated by the actual working tests which were witnessed by the visitors. The wide temperature range, fuel economy, and uniform heating ensured by the Davis "Revergen" furnaces renders them especially serviceable for the various heat treatment operations, case hardening, annealing, billet heating, etc. Amongst operations to which this furnace can also be applied on a successfully commercial basis is the heat treatment of refractory materials for which extremely high temperatures are required.

The demonstrations were arranged to give the actual working results in the three general uses for which the furnace is designed, viz., that on the 18th "annealing," on the 19th "billet heating," and on the 20th "firing refractories." Each of these tests was carried out in the presence of the visitors, and all the figures, including the reading of the gas meter both before and after each operation, were checked by the visitors.

The following are the details of the results obtained in the operation of billet heating to a temperature of 1000 deg C. It will be noted that three separate charges were made, the oven being raised to the required temperature in the first place. The extra time and gas consumed on the second and third charges was in consequence of the heat losses during the drawing and recharging operations :—

OPERATION.—Billet heating to 1000 deg. C.

FIRST CHARGE.—20 billets. 985 lb.
Time in.—11.9 a.m. *Meter.*—4,067,700.
Time out —12.24. *Meter.*—4,069,100.
TIME TAKEN.—1.15. *Gas used.*—1,400 c. ft.
Gas per lb. 1·421 c. ft. } Efficiency.
Gas per ton 3,183 c. ft. }
Drawn at 1025 deg. C. Thermo-couple pyrometer.
,, 1025 deg. C. Fery pyrometer.

SECOND CHARGE.—20 billets. 980 lb.
Time in.—12.35 p.m. *Meter.*—4,069,100.
Time out.—1.55. *Meter.*—4,070,675.
TIME TAKEN.—1.20 hours. *Gas used.*—1,575 c. ft.
Gas per lb. 1·60 c. ft. } Efficiency.
Gas per ton 3,599 c. ft. }
Drawn at 1020 deg. C. Thermo-couple pyrometer.
,, 1020 deg. C. Fery pyrometer.

THIRD CHARGE.—20 billets. 987 lb.
Time in.—2.5 p.m. *Meter.*—4,070,675.
Time out.—3.25. *Meter.*—4,072,250.
TIME TAKEN.—1.20 hours. *Gas used.*—1,575 c. ft.
Gas per lb. 1·59 c. ft. } Efficiency.
Gas per ton 3,561 c. ft. }
Drawn at 1020 deg. C. Thermo-couple pyrometer.
,, 1020 deg. C. Fery pyrometer.

NOTE.—The average exhaust gas temperature was 180 deg. F. At no time did the thermometers record a temperature in excess of 200 deg. F. The average calorific value of the gas used throughout the day was 463 B.T.U.'s per c. ft.

In the annealing test 20 billets of a total weight of 987 lb. were used. These were raised from cold to a temperature of 820 deg. C. in 1–15 hours, with a total gas consumption of 1,350 c. ft. = 1·37 c. ft. per lb. of steel. The gas used to maintain the temperature was for first hour 300 c. ft., second hour 200 c. ft., and for third hour 325 c. ft., making an average for the three hours of 292 c. ft. = ·294 c. ft. per lb per hour.

In the high temperature test on refractory materials the total time taken was 5½ hours and the gas consumed was 7,850 c. ft. The final temperature obtained was 1690 deg. C. For the first hour and a half of the run the furnace was maintained at a steady temperature of 1490 deg. C., the gas consumed being 1,350 c. ft. During the last hour of the run at the maximum temperature the gas consumption was at the rate of 1,450 c. ft. The average calorific value of the gas used during the day was 451 B.T.U.

TRADE PUBLICATIONS.

ELECTRICAL ARC WELDING.

The Equipment and Engineering Company, of 2 and 3, Norfolk Street, London, W.C., have issued four leaflets on electrical arc welding plant. One of these leaflets is illustrated in colour, and is intended to show tramway engineers and others interested that the process is so simple that it can be carried out by ordinary labour, while repairs can be effected at small cost, that the saving of scrap parts is considerable, and that the plant can be considered as a paying investment. The illustrations show gear cases, brake hanger links, lever fulcrums, tramway pinions, and crossings which have been welded.

PATENT STAIR TREADS.

Messrs. Hughes, Bolckow and Company, Limited, of Blyth, Northumberland, have issued a circular describing the Andrews-Hawksley patent stair treads. These treads can be fitted to iron staircases with cast-iron bed risers, or plate risers, or, if necessary, they can be made with end lugs for bolting to stringers. The Number 2 type, with wrought-iron frames fitted with hardwood blocks, are four times reversible. The blocks are old seasoned ship oak or battleship teak wood. They provide a non-slipping, silent, unbreakable, and fireproof tread. They have been largely used by the Admiralty, the War Office, and railway companies.

COAL AND ASH PLANT.

A new catalogue on "Coal and Ash Plant," issued by Ed. Bennis and Company, Limited, Little Hulton, Bolton, and 28, Victoria Street, London, S.W.1, consists of 64 pages of text fully illustrated and covers a wide range of application. Owners and managers who want to increase output, reduce costs, eliminate waste, and attain the maximum of efficiency in their handling and burning of fuel, will find catalogue suggestive and helpful.

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NEW AND PROSPECTIVE WORK.

Bolton Tramways Committee propose to re-lay the track on the Daubhill route, and have approved of the purchase of the rails, points, and crossings required.

Nottingham Electricity Committee's recommendations for the installation of new working plant at an estimated cost of £55,000 has been accepted by the Council.

Stirling Council have decided to obtain expert advice with regard to the present position of the tramway undertaking with a view to its purchase and subsequent electrification.

Bexley Council requires £13,000 for the reconstruction of the tramway track, and has asked the War Office, the Ministry of Munitions, and the Road Board for financial assistance.

Plymouth Corporation propose to spend £210,000 on tramway extensions and renewals, including a new line to the Laira district and further lines to connect the tramways of Plymouth and Devonport.

Halifax Corporation have informed Stainland Urban Council that they will extend the tramways to Stainland as quickly as possible, but owing to the shortage of labour and the high cost of material a definite date cannot be given.

Bradford Tramways Committee propose to order twenty-six new cars and fifty-two traction motors. The chairman and deputy chairman have been empowered to place orders forthwith, and to press for delivery at the earliest possible date.

Of the Rotherham permanent way five miles of single track requires immediate attention and doubling at a cost of £50,000, and a new five-mile single track is required at a cost of £60,000. It is also desired to expand the tramways to Wickersley.

Ilford Council are making application to the Local Government Board for sanction to a loan of £25,000, the expenditure required for the purchase of new plant, etc., for the electricity undertaking, which has been recommended by Mr. A. H. Shaw, the electrical engineer.

Huddersfield Corporation are promoting a Bill for the construction of a tramway to bring their system to the centre of Brighouse. Brighouse Corporation have pressed for the construction of the line, and Huddersfield Tramways Committee have agreed to carry out the scheme as soon as practicable.

Liverpool Tramway and Electric Power Committee propose that application be made to the Local Government Board for sanction to borrow £200,000 for generating plant, £190,000 for electric mains, £70,000 for new cars, £65,000 for motor omnibuses, £15,000 for motor garage and equipment, and £10,000 for a new car shed; total, £550,000.

Oldham Town Council have promoted a Bill to authorise the construction of a tramway along Oxford Street to Butler Green to link up tramways which Chadderton Urban Council propose to seek powers to run from Chadderton, *via* Gorse Mill, to Butler Green. It is estimated that the work could be carried out in three months, but provision would be made for it to be completed within five years.

West Hartlepool Council have authorised the Tramway Committee to purchase six new cars, three pairs of maximum traction trucks complete with electrical equipments, and nine sets of electrical equipments, at a total estimated cost of £24,187. The £15,375 required for the cars is to be borrowed if the Board of Trade permit. The passengers carried have increased from 3½ millions in 1914 to over 8 millions per annum.

Leeds Sub-Tramways (Works Management) Committee, after considering proposals for an estimated expenditure on tramway permanent way of £70,000, have approved the plans and have directed the general manager to obtain tenders for material and labour for works in Boar Lane, Meadow Lane, and Park Lane. Work on the reconstruction and renewal of highways in Boar Lane, Park Square, and other streets is also to be undertaken at an estimated cost of £5,926.

Sorbitic Treatment of Rails at Bournemouth.—Mr. I. Bulfin, general manager of Bournemouth Corporation Tramways, has received a quotation from Scholey and Company, Limited, for the application of the sorbitic treatment of rails at the price of £1 per yard of single track. The manager has reported to the committee that this treatment is estimated to increase the life of the permanent way by 50 per cent., and he proposes to experiment on a mile of single track at a cost of £1,700. The committee approved the plan, and the work will be commenced without delay.

FINANCIAL REPORTS AND MEETINGS.

Scarborough South Cliff Tramway Company.—At the annual meeting of this company on January 20, a dividend of 6 per cent. was declared and £113 was carried forward.

City of Buenos Ayres Tramways.—A balance dividend is declared of 1s. 3d. per share, making 5 per cent. per annum, less income tax, for the year ended December 31 last.

Metropolitan Railway Company.—A dividend has been declared on the ordinary stock at the rate of 1½ per cent. per annum for the past half-year, making 1½ per cent. for the year, after placing £20,000 to general renewals fund and carrying forward £10,000.

London United Tramways Company.—Resolutions have been adopted approving the reduction of the company's capital from £2,500,000 to £650,250, divided into £125,000 preference shares of £5 5s. each, to be sub-divided into 21 fully paid shares of 5s. each, such shares to be converted into ordinary shares of 5s. each.

Dover Tramway Estimates.—The estimates submitted to the Dover Tramways Committee show a probable deficit for the year ending March, 1920, of nearly £10,000, due principally to the heavy cost of track repairs. Powers for a loan are to be sought for the purchase of several new cars.

Castlederg and Victoria Bridge Tramway.—The working for the past year, after providing for interest, shows a balance of £750, which the directors recommend should be carried forward. The board regret to record the death of their chairman, Dr. T. Leary, one of the promoters of the line. The vacancy has been filled by the appointment of Major G. F. V. Leary.

Carlisle Tramways Company.—The report for 1918 states that after providing for debenture interest and appropriating £1,500 for redemption of second debentures, there is a balance at the credit of profit and loss account amounting to £221, which the board recommend should be carried forward. The improvement of just over £2,000 in the receipts was offset by largely increased expenditure.

Falkirk and District Tramways.—In moving the adoption of the report for the year ended October 16, 1918, at the annual meeting on February 20, Mr. G. Balfour, M.P., stated that the traffic receipts showed an increase of £6,800, or about 30 per cent. Expenses of operating had considerably increased, largely owing to wages increases due to Government awards. A dividend of 7 per cent. per annum, less tax, was declared on the share capital, and £1,322 was carried forward.

Tramways, Light and Power Company.—The report for the year ended December 31, 1918, shows a profit of £42,321, which, added to £5,277 brought forward, gives £47,599. Deducting loan and debenture interest, less tax, £12,396, debenture redemption account £3,183, and interim dividend on preference shares to June 30, 1918, less tax, £7,107, there is left £24,913. The directors propose a final dividend on preference shares to December 31, less tax, to transfer to reserve fund £12,000, and to carry forward £5,806.

Liverpool Overhead Railway Company.—A dividend has been declared at the rate of 5 per cent. per annum on the preference shares and 4 per cent. per annum, making 3¾ per cent. for the year, on the ordinary shares, leaving a balance of £6,119 to be carried forward. The gross receipts under the terms of agreement with the Government amounted to £143,361, and the working expenses, including appropriation to reserve funds, to £113,234, leaving £30,127. Deducting debenture interest (£6,755) and including the balance brought forward (£6,928), there is a balance available for dividend of £30,300.

Llandudno and Colwyn Bay Electric Railway.—The report for the year ended November 30 shows that the total receipts amounted to £23,271, and expenditure, including interest on debentures and loans, to £15,333, leaving a balance of £7 938. Including £197 brought forward, there is an available balance of £8,135. Of this amount, sinking fund instalment requires £1,775, and £1,500 has been transferred to reserve for renewals. A dividend at the rate of 4½ per cent. per annum has been declared, leaving £387 to be carried forward. No construction work has been done during the year, but it is hoped to effect certain improvements at an early day.

Isle of Thanet Electric Tramways.—Since the Armistice was signed there has been a considerable improvement in the receipts of the Isle of Thanet Electric Tramways and Lighting Company. It was mentioned at the annual meeting that the receipts of the tramways for the past year showed an increase of £258. The receipts for the lighting department fell off by £1,196, owing to the restrictions on lighting and the necessity for reducing coal consumption The accounts for the year ended September 30, 1918, showed a loss of £4,817, and deducting the credit balance of £3,825 brought forward, there is a debit balance of £992 to be carried forward. In the previous year the loss was £4,731.

Leicester Corporation Tramways.—The report for 1918 shows traffic revenue £237,821 (1917, £191,636); other revenue £57,094 (1917, £52,012); total £294,916 (£243,648). Working expenses £218,506 (1917, £172,583); balance £76,409 (1917, £71,065). The car miles totalled 3,726,462, and passengers 50,983,223. The percentage

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of working expenses to receipts was 70 per cent.; the average traffic revenue per mile was 15·317d.; average expenses, including power cost, 14·072d. per mile. The sinking fund stands at £255,443, and the amount of reserve or renewals fund is £83,808, on a gross capital expenditure of £933,912. The working expenses, £218,506, were £45,923 over 1917, due to increased charge for power, war bonus to employees, and higher price of materials.

THE ENGLISH ELECTRIC COMPANY, LIMITED, went to allotment in the middle of February. It will be remembered that this company having arranged to acquire the entire holding of preference and ordinary shares in the Coventry Ordnance Works, Limited, and the Phœnix Dynamo Manufacturing Company, Limited, made an offer to the shareholders of Dick, Kerr and Company, Limited, to exchange shares on certain terms. It is now announced that about 90 per cent. of the Dick-Kerr shareholders have accepted the offer. The English Electric Company, Limited, will control directly or through Dick, Kerr and Company, Limited, the following powerful group of manufacturing interests, viz.:—The Coventry Ordnance Works, Limited, Dick, Kerr and Company, Limited, the United Electric Car Company, Limited, and Willans and Robinson, Limited. The company is registered with a capital of £5,000,000 in 1,500,000 £1 preference and 3,500,000 in £1 ordinary shares, and the issued capital on allotment is just under £2,000,000.

LEEDS TRAMWAY ESTIMATES.—The estimates for the current year indicate that the revenue in traffic receipts will amount to £716,440. Including sundries, estimated at £8,530, there is a total of £724,970, an increase of £138,339 as compared with last year, or 26 per cent. The increase in income is attributed mainly to the increase in fares which took place in June last. The estimated number of passengers for the current year is 113,129,800, or a decrease of 9 per cent. It is expected that in the following year it will be possible to run more cars in order to cope with the increased traffic, and an additional income is anticipated of £77,670, making an aggregate of £802,640. The surplus profit applied to the relief of the rates last year was £38,000. The increased income does not, of course, indicate a prospective increase in profits owing to the great advance in war bonuses and the cost of material. The wages bill for the current year is approximately £258,000, or £60,500 more than last year, but the full effect of the advance has not yet been felt, as the whole of the increase was not paid throughout the year.

FIFE TRAMWAYS, LIGHT, AND POWER COMPANY.—The annual meeting was held on February 19. Mr. W. Low, chairman, proposed the adoption of the report and accounts. The gross revenue was £43,323 against £33,677, and the available profits £38,652 against £30,578. The amount carried forward is £5,095 against £8,390. The tramway from Dunfermline to Rosyth Naval Dockyard was opened on May 17, and had proved an exceedingly satisfactory addition. The cars ran 807,195 miles, compared with 600,000 miles in 1917, and carried 8,000,000 passengers, compared with 4,905,106. Of the total passengers, 2,500,000 were carried on the Rosyth section, and these passengers were divided into naval ratings, 50 per cent.; workmen, 20 per cent.; ordinary traffic, 30 per cent. The total traffic receipts amounted to £70,700, as against £38,807 during the preceding year, or approximately 82 per cent. increase. This is largely due to the Rosyth line, and compares with a total increase in passengers carried of 63 per cent. The tramways paid over as dividend and management fees £25,250, as against £17,050. The power company continued to make very substantial progress. The revenue paid over by the power and lighting undertakings as fees and dividends amounted to £18,045, as against £10,615.

YORKSHIRE AND DISTRICT TRAMWAY MANAGERS' ASSOCIATION.—A meeting of the Yorkshire and District Tramway Managers' Association was held at the Leeds Tramway offices on February 11. The following members were present:—Messrs. J. B. Hamilton (Leeds), H. Webber (Keighley), S. Clegg (Lincoln), W. A. Toppin (Chesterfield), A. A. Blackburn (Huddersfield), H. Cordukes (Scarborough), H. Jagger (Rotherham), H. L. White (Grimsby), R. H. Wilkinson (Bradford), W. E. Nicoll (Barnsley), A. Daggett (Leeds), J. W. Galloway (Halifax), W. McGibbon (Mexboro' and Swinton), H. England (Wakefield). Mr. J. B. Hamilton took the chair and extended a hearty welcome to Mr. Toppin, who has succeeded Mr. Acland in Chesterfield, and also to Mr. Blackburn, who has been appointed general manager of the Bradford tramways. An interesting discussion took place respecting the demand for a shorter working week, increased car services, liability of tramways respecting parcels traffic, etc. It was decided to hold meetings quarterly in future, but the honorary secretary was authorised to summons a meeting whenever he thought it advisable.

ACCOUNTS OF THE UNDERGROUND GROUP.—The report of the Underground Electric Railways Company for 1918 includes a new statement summarising the results of the associated companies. After providing for expenses the company's income from investment was £760,264 against £606,730 for 1917, and after payment of 5 per cent. for the year on the 6 per cent. income bonds, against 4 per cent. for 1917, there remains £36,693 to be carried forward. The income from the London General Omnibus was £179,758, as against £112,033 for 1917. Associated Equipment produced £205,468, compared with £126,000; the London Electric Railway £232,543, against £140,337; the District £76,650, or £41,213 more; and City and South London £45,687, compared with £28,381. Last year's income of the Underground Company was equivalent to 5 per cent. on the total capital. The Associated Equipment Company took over the manufacturing department of the Omnibus Company and is the most profitable constituent of the group. It pays 14 per cent. on a million capital, and is a bigger source of profit to the Underground than is the Omnibus Company itself. During the year it has been almost wholly occupied in making 3-ton lorries for the Government, but is now at work replacing the company's omnibuses and manufacturing for general sale.

TYNESIDE TRAMWAYS AND TRAMROADS COMPANY.—For the year 1918 the surplus of receipts over expenses is £9,297 18s., which, with the balance brought forward from last half-year of £1,696 16s., makes a total to the credit of profit and loss account of £10,994 14s. After deducting interest on debentures, loans, etc., amounting to £1,012 13s., there is an available balance of £9,982. This profit the directors propose to appropriate as follows:—Dividend on preference shares at the rate of 5 per cent. per annum (less income tax), £601; in the payment of a dividend on ordinary shares at the rate of 5 per cent. per annum, making, with the dividend paid in September last, 5 per cent. for the whole year, being the same as for the year 1917, £3,347 10s.; payment to ordinary shareholders of a bonus at the rate of 2s. per share, £1,339, for renewals, depreciation, etc. (which, with £909 interest on investments, will increase that fund to £33,566), £1,400; special reserve account, to meet contingencies, £1,000; carrying forward to next half-year £2,294. The traffic receipts show an increase of £3,373 17s., as compared with the corresponding half-year of 1917, and for the whole year there is an increase of £9,527 11s. The car miles totalled 617,980, as against 646,846 in 1916 and 724,697 in 1914. Other items for the same three years were:—Passengers (Tyneside Company's lines), 10,276,770, 7,261,986, and 6,740,161; total traffic receipts, £52,581, £31,463, and £31,819; gross profit, £18,246, £10,352 and £12,009.

THE LANCASHIRE UNITED TRAMWAYS, LIMITED.—The ordinary general meeting of the above company was held at Winchester House, London, E.C., on February 25. The Hon. Sir Arthur Stanley, G.B.E., chairman, in submitting the report and balance sheet to December 31 last, stated that the receipts of the combined undertaking for the year showed an increase of £40,827, and that the expenses had also increased by £25,925. After paying the interest on the company's prior lien and second mortgage debenture stocks, the balance remaining had been placed to renewals or carried forward. The lease of lines held by the New St. Helens and District Tramways Company, Limited, of which this company holds about 80 per cent of the capital, expires on September 30 next, the St. Helens Corporation having definitely decided to run the lines themselves. The company has decided to resume the motor coach traffic which was interrupted on the outbreak of war, as from the experience gained during the summer of 1914, there is undoubtedly a great demand for this traffic. The chairman expressed the sincere sympathy of the board with the dependants of those employees who have been killed in the war. He also read a letter from Sir Ernest Clarke, director of the Motor Ambulance Department of the British Red Cross Society, conveying the grateful thanks of his department to the staff and employees of the company for the generous contributions which they have made to the Red Cross funds during the period of the war.—The report to December 31 last gives the result of the working of the combined undertaking as follows:—Traffic receipts, £160,867; electrical energy sold and miscellaneous receipts, £21,174—total, £182,041; less working expenses, £91,442; cost of generating electrical energy sold, £14,586; general charges (including direction, management, etc.), £6,647; rent of leased lines, £5,191; leaving £64,375. Adding dividend on holding in the New St. Helens and District Tramways Company, £3,068, the profit of combined undertaking is £67,443. Receipts show an increase of £40,827, the traffic earnings per car mile amounting to 17·85d. The increase in expenditure amounted to £25,925. The directors have decided to develop the motor transport business in conjunction with the tramways system, and have placed orders for 25 motor coaches. The lease of the lines held by the New St. Helens and District Tramways Company from St. Helens Corporation expires on September 30 next. Negotiations have been carried on with the Corporation for the renewal of the lease, but without result. The company holds about 80 per cent. of the issued capital of the New St. Helens and District Tramways Company. It is not anticipated that the revenue of the company will be materially affected by the change. The interest and dividends received from the operating companies, together with sundry receipts, amounted to £19,973. After deducting interest on the prior lien debenture stock and expenses, there remains a balance out of which the full interest of 5 per cent., less tax, will be paid on the second mortgage debenture stock for 1918. The balance on the year's working of the operating companies, after payment of the interest and dividends, is £40,111. The depreciation and renewal accounts and amounts carried forward amount to £112,962.

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PERSONAL.

Mr. Thomas Clarkson has been elected president of the Institution of Automobile Engineers for the ensuing year.

Mr. W. J. McCombe, manager of Hull Corporation Tramways, has been granted an increase in salary of £200 to £800.

Alderman R. T. Fletcher has resigned the chairmanship of the Wigan Tramways Committee on the ground of ill health.

Mr. J. H. Thompson, of Carlisle, has been appointed electrical engineer to Colne Corporation, at a salary of £350 per annum.

Mr. J. A. Crowther, electrical engineer of Wallasey, has been granted an increase in salary to £800, by four yearly instalments of £50.

Mr. W. McClelland, O.B.E., has been appointed by the Admiralty director of electrical engineering, succeeding Mr. C. H. Wordingham, C.B.E.

Mr. G. W. Holford, general manager of Salford Corporation Tramways, has been granted an increase in salary from £700 to £750 a year.

Mr. E. Sedgwick, of Rochdale, has been appointed depot superintendent of Southport Corporation Tramways at a salary of £250 a year.

Mr. T. Owen, traffic superintendent of the East Ham tramways department, has been granted an increase in salary to £250 per annum.

Mr. R. R. Greene, tramways manager of Wallasey Corporation, has been granted an increase in salary to £700 by two instalments of £50 per annum.

Wolverhampton Corporation has fixed the salary of **Mr. C. Owen Silvers,** general manager and engineer of the tramways department, at £600 per annum.

Mr. A. Letts, electricity station superintendent of Lincoln, has been granted an increase in salary to £300 per annum, rising by two annual increments to £350.

Mr. W. L. Larkin read an interesting paper on "Electric Welding and Its Applications" at the Royal Society of Arts on March 12. Sir R. A. Hadfield presided.

Mr. H. E. Stilgoe, city engineer and surveyor of Birmingham, is nominated as president of the Institution of Municipal and County Engineers for the year 1919-20.

Sir Eric Geddes, in view of his duties as Minister of Ways and Communications, has resigned his appointment as deputy general manager of the North Eastern Railway.

Mr. C. C. Hawtayne has been appointed consulting engineer by Maidstone Town Council for the proposed extension of the tramways, in succession to the late Mr. Stephen Sellon.

Lieut. Ernest Leighton, of the Air Force, who joined the Army in 1914, has now resumed his position as manager of the installation department of Messrs. C. A. Vandervell and Company.

Major H. Clifford Palmer, manager of the publicity department of the General Electric Company, has resumed duty after an absence on service during the whole period of the war.

Mr. H. C. Lester, who had been with Dennis Brothers, Limited, of Guildford, for 15 years, has now accepted a position with Wells and Mayner, Limited, automobile engineers, of Birmingham.

Mr. J. J. McGregor has been appointed charge shift engineer and boiler house superintendent at Greenwich power station of the London County Council at a salary of £300, rising to £400 per annum.

Lieut. V. H. M. McMahon, R.A.S.C., M.T., of Cheetham, Manchester, was married to Miss Alice Winifred Hodson, of Octagon House, Fairfield, Manchester, on February 19, at St. Ann's Church, Fairfield.

Mr. C. F. Spencer, chairman of Halifax Corporation Tramways, has resigned the position of director-general of the National Kitchens Division of the Ministry of Food, owing to the demands of his business engagements.

Messrs. Coote and Harris have been appointed by Bexley Council to represent them on the Metropolitan Municipal Traffic Council, which has been formed to take the place of the Metropolitan Association of Tramway Managers.

Sir Sam Fay, general manager of the Great Central Railway, relinquishes his appointment as Director-General of Movements in Railways, at the end of this week. Sir Sam Fay succeeded Sir Guy Granet in this appointment a few months ago.

Mr. F. M. Foster, assistant engineer and manager of Norwich Electric Tramways Company, has been appointed engineer and acting manager in succession to Mr. F. W. Ketley, who recently resigned the management of the above company.

Mr. J. B. MacKinnon, traffic superintendent of the London United Tramways, was, on the resignation of Mr. W. E. Hammond, appointed general traffic superintendent of the Metropolitan, the London United and the South Metropolitan Tramways.

Mr. J. B. Hamilton, commercial manager, Leeds Corporation, has been elected as one of the seven representatives of the Council of the Association of Municipal Corporations on the National Joint Industrial Council for Local Authorities Non-trading Services.

Mr. T. W. Bloxam, chief electrical engineer to Belfast Corporation, has been granted an increase in salary from £800 to £1,000. In 1914 his yearly increase of £50 was arrested owing to the war, and the present increase is the amount he would have received by this time.

Mr. S. L. Pearce, chief engineer and manager of Manchester Corporation electricity department, has been granted an increase in salary from £1,500 to £2,000 per annum. **Mr. W. E. Foden,** financial superintendent, has been granted an increase from £500 to £600 per annum.

Mr. P. F. Sullivan, at a meeting of the Institution of Civil Engineers of Ireland, on March 3, read a paper on "Tramway Curves and Special Work." The paper was accompanied with plates of various forms of curves, which were dealt with from a geometrical and mathematical point of view.

Lieut. Peter D. Fisher, R.F.A., youngest son of Mr. Peter Fisher, general manager of Dundee Corporation Tramways, has been awarded the Croix de Guerre. Lieut. Fisher, who is 22 years of age, enlisted in the A.S.C. in the first month of the war, but shortly afterwards was transferred to the R.F.A., in which he received a commission. He was wounded in June, 1916, but remained at his post.

Management of Wigan Tramways.—From the applicants for the position of general manager of Wigan Corporation Tramways, the following short list was selected:—Lieut. L. Bellamy, R.E. (Ilkeston), Messrs. William Billington (Salford), H. Clayton (Preston), W. H. Ellis (Chester), Benj. Hall (Keighley), and A. B. Slater (Burton-on-Trent). Subsequently Mr. William Billington was appointed to the position at a salary of £500 per annum.

Sir Arthur Stanley was on February 11 presented with his portrait, a silver salver, and an album containing the names of 630 subscribers on the headquarters committee and staff of the Red Cross and the Order of St. John, in recognition of his work as chairman of the Joint War Committee of those bodies. In reply Sir Arthur said he should give the salver to St. Thomas's Hospital. He intended to convene a Red Cross Convention at Geneva, with the object of promoting public health and infant welfare during the period of reconstruction.

L.C.C. Boiler House Superintendent.—In connection with the reorganisation of the electrical branch of the London County Council Tramways Department, the details of which were approved by the Council on December 8, 1917, authority was given for the appointment of one additional charge shift engineer at Greenwich power station. Mr. J. J. McGregor was then appointed boiler house operating charge engineer, and the Highways Committee stated on February 18 that he has carried out his duties in a most satisfactory manner. They now proposed that the arrangement should be somewhat modified, and that a new appointment as boiler house superintendent should be provided, the salary being fixed at £300, rising by annual increments of £20 to £400 a year, and that Mr. McGregor should be appointed to that position. Under this arrangement the number of charge shift engineers would be reduced by one and Mr. McGregor would be in entire charge of the boiler house under the power station engineer and the assistant power station engineer. It was recommended that he shall continue to receive the special temporary allowance of £50 a year, in addition to the war bonus applicable to the technical staff.

Mr. J. A. Kenny, who for eight years was engineer with the Paisley and District Tramways Company, and who has left the service of the company to enter into partnership in a business in Dublin, was presented with valuable gifts from the directors and the employees. The members of the running staff gave him a gold watch, suitably inscribed; headquarters gave him a gold chain in keeping with it, and the directors a costly case of engineers' measuring and drawing instruments, along with a case of silver-mounted briar pipes with amber mouthpieces. Major Fred Coutts, general manager, who made the presentation, spoke in felicitous terms of the high qualities of Mr. Kenny as engineer and of his loyalty to the company. They all regretted that he was leaving them. Among Mr. Kenny's many fine qualities, he desired to mention his rare tact in dealing with men on the permanent way, as he had managed that department so efficiently and so carefully that he (Major Coutts) had never on any single instance to interfere. Nor had he ever worried on any occasion of emergency or breakdown if Mr. Kenny was in attendance, for he then knew all would be well.

Mr. J. Kenny, in his reply, said it was a great pleasure to know that he carried with him the good wishes and the esteem of the directors and employees. He rejoiced that their esteemed manager, Major Coutts, had made reference to the good relations which subsisted between him (Mr. Kenny) and his men, as it gave him the opportunity of acknowledging the loyalty and the readiness with which they had at all hours assisted him in whatever had to be undertaken. Mr. Kenny cordially thanked the directors, staff, and general employees for their kindness, and assued them that wherever his lot might be cast, he would ever bear with him pleasing recollections of the years he had been in the service of the Paisley and District Tramway Company.

At the function there was a large attendance of officials and employees, as well as of well-known public men representative of Johnstone, Barrhead, Renfrew, and Paisley.

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Major Henry Mattinson, R.E., A.M.Inst.C.E., Chief Civil Engineer, Manchester Corporation Tramways, has recently arrived home from Syria on demobilisation. Major Mattinson joined the East Land Field Company R.E. (T.) in 1915. After a period as Adjutant, and subsequently as Superintendent of Instruction in Bridging to the Western Command R.E. Training Centre, he proceeded to Egypt, where he was appointed Construction Engineer to the Light Railways Directorate E.E.F. He was responsible for the construction of about 100 miles of 60 cm. and 2 ft. 6 in. gauge railways to various points in the front line, of which a line 20 miles in length due north from Jerusalem and over most wild and rocky mountainous country was constructed at the rate of three-quarters of a mile per day. After the successful advance of the army from September, 1918, Major Mattinson carried out the restoration of the captured Turkish railways to Haifa, Deraa, Damascus, Beirut, and Aleppo, some 500 miles in length, considerably destroyed by the retreating forces, and had the satisfaction of completing this work before being demobilised.

Mr. Robert B. Holt.—We have to announce the departure of another prominent tramway man from the ranks of municipal officials. Mr. Robert B. Holt, M.I.Mech.E., M.Inst.C.E.I., who has been identified with the Leeds Corporation Tramways for many years, has resigned the office of City Highways Engineer and Permenent Way Engineer of the tramways in order to take up an important appointment on the staff of Messrs. C. P. Sandberg, consulting engineers, of Westminster. As announced in our issue of April 11, 1918, Messrs. C. P. Sandberg have developed a process for increasing the life of tramway rails *in situ*, without disturbing the traffic or the pavement. This treatment is now being applied on the Croydon, the Manchester, and the Birmingham tramways. The process will undoubtedly prove of great value to tramways, and Messrs. Sandberg are fortunate in having secured the services of so able and experienced an engineer as Mr. Holt, who not only has special knowledge of tramway track, but has also for many years devoted much attention to the metallurgical question of steel rails. Mr. Holt collaborated with Messrs. Sandberg in connection with the original experiments both of the Sandberg sorbitic process and the Sandberg *in situ* treatment of rails. During

Mr. Robert B. Holt.

the past two years Mr. Holt has been connected with the Admiralty's Labour Department, and for a considerable time held the position of District Director for the North East.

We regret to record the death of **Lieut. Harold Hugh Hirst,** which took place on February 24, at his home, 5, Weymouth Court, Portland Place, London, from pneumonia following influenza. Lieut. Hirst, who was born in 1893, was the only son of Mr. Hugo Hirst, chairman and managing director of the General Electric Company, Limited. At the time of the outbreak of war he was in France. On returning to England he had a serious illness, but immediately on his recovery in October, 1914, he joined the Inns of Court O.T.C., and in March, 1915, received a commission in the 21st Manchester Regiment. After acting as divisional signal officer to the 30th Division in England, in February, 1916, he proceeded to East Africa with the No. 1 East African Special Visual Signal Company. Owing to malaria and dysentry he was invalided home towards the end of 1916. On recovering from a protracted illness, he was transferred in June, 1917, to the Wireless Service, in which he acted as instructor. He proceeded to France in the summer of 1918, and took his share in the operations preceding the armistice. The strain of the campaign, combined with the effects of gas, broke down his health again, and he was invalided home at the end of October.

THE LATE MR. STEPHEN SELLON.

A brief notice of the career of the late Mr. Stephen Sellon was given in our issue of January 16, following his death, which occurred suddenly in December last. For the fuller biographical sketch which follows, and for the accompanying photograph of Mr. Sellon, we are indebted to Mr. Arthur R. Hoare, who, with Mr. S. Rutter Fletcher, in accordance with Mr. Sellon's wish, are continuing his practice.

The late Stephen Prescott White d'Alte Sellon, M.Inst.C.E., was a son of the Rev. W. E. Sellon, of Kentchurch Rectory, Herefordshire. Mr. Sellon was educated at Uppingham School and King's

The Late Stephen Sellon.

College, London. He served his time in the works of Messrs. Hamilton and Company, marine engineers and bridge builders, was a pupil of the late Mr. Meeke (engineer to the Lancashire and Yorkshire Railway), and afterwards became assistant resident engineer on the West Kent Main Drainage Works under Sir Joseph Bazalgette and Mr. Alfred Williams. Subsequently he was resident engineer to Mr. Hennell, on the Darenth Valley main drainage, then joined Mr. Hennell's staff, and took part in many important promotions, including the Barry Railway, the Lancashire plateways, and the Manchester Ship Canal. In 1885 Mr. Sellon turned his attention to light railways and tramways, and was engaged in the promotion of several Irish relief railways. On returning to England he constructed the Wolverton, Stony Stratford and District Light Railways, and the Newport Pagnell and Olney Tramways, the first lines of the description in the country running along the high road and dealing with passengers, goods, and mails.

At this period he was consulted by the Royal Commission on the development of Irish industries, and afterwards went on tour with them. Having satisfied himself of the advantages to be obtained by substituting electric traction for steam and horse traction, Mr. Sellon obtained a concession from the Corporation of Leeds to equip a section of their tramways. The concession was handed over to the Thomson-Houston Company, of America, who equipped and worked the line, this being the first overhead "trolley" system in England. Shortly after the line commenced working the National Telephone Company endeavoured to obtain an injunction on account of the telephonic disturbance which it caused, and Mr. Sellon visited many systems in Europe to collect evidence for the purpose of resisting this attack. The subsequent victory over the telephone company, by the well-known judgment of Mr. Justice Kekewich, and the decision of the Joint Committee of 1893, made the Leeds electric tramway enterprise the starting point of the subsequent development of electric traction in England. Mr. Sellon was shortly afterwards invited by Lord (then Mr.) Bryce to join his Committee on Light Railways at the Board of Trade, the result of the committee's report being the passing of the Light Railways Act of 1896. He then became concerned in the formation of a traction department under the Electric Construction Company, and was afterwards appointed chief engineer to the British Electric Traction Company. He resigned this appointment in 1903 in order to devote himself entirely to his private practice as consulting engineer. Mr. Sellon's work of recent years is well known. He acted professionally for very many Corporations and companies in Parliamentary and arbitration cases, and in the construction and equipment of numerous tramways, light railways, and electric lighting undertakings.

In 1904 he was appointed by the Royal Commission on London Traffic to inquire into and report upon the tramway systems of the United Kingdom, more especially in relation to their effect in solving the housing problem and their function as part of the general system of transit in their respective districts. His extensive and exhaustive report was published in Volume IV. of the Commission's report.

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Mr. Sellon was one of the founders of the Tramways and Light Railways Association in June, 1897, and he was a member of the Council up to October, 1908, when he was elected a vice-president and made an hon. member of the Council. He always took a prominent part in the work of the association.

In 1917 Mr. Sellon undertook in a voluntary capacity the position of District Director of Shipyard Labour for the London and East of England District under the Shipyard Labour Department of the Admiralty, but later, as the volume and anxiety of the work outgrew his strength, he was compelled to resign the position. He then acted as adviser to the department in regard to workmen's trams, trains, fares, and means of transit.

When the Tramways (Board of Trade) Committee was formed later in the same year Mr. Sellon was unanimously elected one of the Tramways and Light Railways Association's representatives thereon. He was the author of several papers in connection with the traction industry.

In failing health for some time, he continued his work contrary to medical advice to the last, and died suddenly from heart failure in the train while returning from Edinburgh to London on December 22 last, at the age of 65 years.

TRAMWAY AND LIGHT RAILWAY NOTES.

BELFAST.

TRAMWAYMEN AND UNEMPLOYED PAY—RESUMPTION OF SERVICES—SPECIFICATIONS FOR NEW CARS.

During the strike of shipyard hands in Belfast the Tramways Committee paid wages to the tramway employees, as they did not leave work of their own accord. When the matter came before the City Council, Councillor Turner, while not disagreeing with the payments, remarked that the men had a right to go to the Labour Exchange like other citizens thrown out of work by the withdrawal of power and light, and make a claim for unemployed pay. On February 16 there was a partial resumption of the tramway service, which had been practically suspended since January 25, owing to the stoppage of the power-station by the general strike. The tramway employees had made a claim for a week's wages in connection with their abortive re-start on the previous Tuesday, and a large majority decided not to work. Later there was interference with the running of the cars. A partial service was given on February 17, and on February 18 the full service came into operation, the men returning on the understanding that they would be paid for the previous week. The Tramways Committee have asked the general manager to furnish them with specifications for new cars to accommodate sixty persons. Councillor Turner, chairman of the committee, says it was questionable whether bogie trucks would be suitable. The committee at present have under consideration the advisability of enclosing the ends of the upper decks and also the platforms.

CARDIFF.

SUGGESTED LINKING OF CARDIFF AND NEWPORT TRAMWAYS.

Addressing the Cardiff Rotary Club, Mr. Arthur Ellis, general manager of the Corporation tramways, suggested that there was no reason why, during the next few years, the Cardiff and Newport tramways should not be linked together. It would be necessary to extend tramways into suburban areas to help toward the developments that must come as part of the scheme for freeing the country from the menace of shortage of food. This would have the effect of relieving the railways and leaving them to deal with the longer distance traffic.

EDINBURGH.

FARES AND CARS—THE PROPOSED ELECTRIFICATION.

Mr. R. S. Pilcher, general manager of the Corporation tramways, has submitted to the Tramways Committee a report on the fares to be arranged when the Corporation take over the undertaking on July 1. The present system could be simplified by reducing the number of stages and aiming at cheap penny fares radiating from the centre of the city. Before the stages can be lengthened the Corporation will require to see some prospect of a reduction in the cost of working. A start should be made with the existing 1d., 2d., 3d., and 1½d. transfer fares. Halfpenny fares, which were discontinued some time ago, should not be granted. Children under four years of age should travel free, and those over four and under twelve should pay half fares. The season tickets, except on the Portobello route, where there is a special reason for their use, are rejected. Workmen should be carried at half fares with a minimum charge of 1d. The report has been remitted to a sub-committee for consideration. A sub-committee is considering the whole question of the provision of new cars. It has been suggested that about fifty cars should be got ready when the Corporation take over the tramways. The idea is that the cars should be so constructed as to be convertible, so that they can be utilised when the system is electrified. The Lord Provost, Sir J. Lorne Macleod, has stated that the Corporation propose to acquire and to run motor omnibuses. The conversion of the tramways to electric traction would cost about a million pounds.

LIVERPOOL.

REINSTATEMENT OF STOPPING PLACES—FATALITY DUE TO CRUSH FOR A CAR—TRAFFIC CONGESTION—THE COST OF NEW CARS—OMNIBUSES TO BE MORE THAN DOUBLED.

Certain stopping stations on Liverpool Corporation Tramways, which were abolished some time ago, have been reinstated, owing apparently to public discontent with the changes. At an inquiry into the death of a woman, who was described as a sufferer from heart disease and bad eyesight, the coroner found that she had died from injury to the brain caused by a fracture of the skull due to an accident. She was attempting to board a tramway car and was knocked down in the crush. Suggestions for the construction of an underground railway are receiving the consideration of both the Tramways Committee and the Reconstruction Committee of the Corporation. One scheme includes underground tunnels linking the outer districts with the centre of the city, in which tramway cars would be run. An alternative scheme proposes the widening of roadways so as to obtain higher speeds with the tramway cars. At a meeting of the Tramways Committee on February 21, Alderman Russell Taylor presiding, it was decided to order 25 new tramway cars and 30 motor omnibuses. When these vehicles have been obtained, the Corporation will have 600 cars and 70 motor omnibuses. Owing to the increased cost of electric tramway cars, which is now about three times what it was in 1913, the committee propose to re-fit some of the old cars with new electrical equipment, which will then be serviceable for some years.

LONDON.

AMERICAN RAILS—ENGINEERING EMPLOYEES' REDUCED HOURS—NEW CROSS-TOWN ROUTE—ACCIDENT CLAIMS.

The Metropolitan Electric Tramway Company in 1916, when British firms were prohibited by Government from rolling tramway rails, ordered a small quantity of rails from the United States. At a recent meeting of the Middlesex Council it was stated that the price, including freight and insurance, was £30 per ton. This compares with a pre-war price in the British Isles of £7 10s. In view of the 48-hour week granted to railway employees, and a 47-hour week to engineering trades throughout the country, the London County Council have accepted the award of the Court of Arbitration providing for the institution of a 47 and a 48 hour week in the electrical branch of the tramways department. In the near future the Council will construct a junction between the tramways in Stockwell Road and Clapham Road, thus enabling a new cross-town service to be given from King's Road, Chelsea, to St. George's Church, Southwark, *via* the Plough, Clapham. During the three months ended December 31, 1918, the Highways Committee reported that they had sanctioned the settlement of 380 accident claims against the Council, the cost having amounted to about £3,418. In three other cases a verdict was given against the Council, in which £99 6s. 6d. in costs had to be paid. Three others resulted in the Council's favour, and one was withdrawn.

MANCHESTER.

WELCOME TO EMPLOYEES RETURNING FROM THE WAR.

The Tramways Committee propose to give their employees a suitable welcome on their return from the war. About 700 men have now returned, and it is expected that before long the number of demobilised tramway men will reach 2,000. The estimated expense to be incurred in the reception amounts to £700. The tramway employees themselves are subscribing £350, the committee will contribute £250, and the men's Athletic Society £100.

NOTTINGHAM.

SUNDAY SERVICES RESUMED—TROLLEY WHEEL REPLACEMENT.

The resumption of the tramway service on Sunday was welcomed throughout Nottingham and the suburbs. It had been suspended owing to the shortage of conductors and coal restrictions. At several curves in Nottingham a trial is being given to a device which assists the conductor in replacing the trolley wheel on the wire. It is a mechanical aid for bringing the trolley in line with the overhead wire, thus enabling it to be speedily set running.

SHEFFIELD.

WORKERS AND INCREASED FARES.

A mass meeting of workers at Hadfields, Limited, have passed a resolution protesting against the increase in tramway fares, and urging that a public inquiry should have been held before the decision was taken. It was maintained that the increase would accentuate the housing difficulty.

WOLVERHAMPTON.

ALLEGED INSUFFICIENT VENTILATION OF CARS.

Complaints have been made of insufficient ventilation of the cars of the Wolverhampton District Electric Tramways, Limited. Councillor Quilliam at a recent meeting stated that an improvement was specially required in view of the prevalence of influenza. He thought that the spread of the epidemic was greatly helped by people travelling in the cars, and suggested that the medical officer of health should write to the company on the matter.

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SHEFFIELD TRAMWAYS WORKING AT A LOSS.

THE CASE FOR HIGHER FARES.—GREAT INCREASE IN COSTS PER CAR MILE.

The general manager of the Sheffield Corporation Tramways, Mr. A. R. Fearnley, in a recent report to the Corporation, states that the present fare of a penny from the centre of the city to the outside terminus has, with certain exceptions, been in force for the past 16 years. The only important exception was the halfpenny fare for half-mile stages, which was discontinued in May, 1917. The cost of operation of the tramways has increased enormously during the past four years. Since March, 1915, the increase in weekly wages has amounted to £145,000 per annum, while the cost of material has enormously increased. The cost of operation for the four weeks ended December 8 last, shows a net loss of £2,581, despite the fact that for the four weeks there has been an increase in receipts of £1,600. Working expenses which in 1915 were 8·7d. per car-mile, in December, 1918, were 16·7d., an increase of 8d. per car-mile. The revenue per car-mile has increased from 10·66d. for the year ended March 25, 1915, to 16·45d. at the present time, an increase in revenue of 5·79d. Comparing this with the increase in working expenses of 8d., there is a net decrease of 2·21d. per car-mile. The increased revenue is obtained largely by overcrowding and without a proportionate increase in working expenses. Such overcrowding will require to be discontinued in the near future by the provision of additional accommodation, and this will mean additional expenditure without a corresponding increase in receipts. It is therefore clear that the department cannot continue to pay its way at the present fares. The increase in the cost of working the motor transport vehicles, which began shortly after the commencement of the war, has continued up to the end of 1018, and in the last six months of that year petrol alone cost 5½d. per omnibus-mile. There has been a loss since September last of ¾d. per mile, and unless the omnibuses are worked at a loss a further increase in fares will be necessary. The Tramways Committee has recently received offers for 50 cars which are urgently required to accommodate the morning and evening traffic. In December, 1916, tenders were obtained for new cars, but the order was stopped by the Ministry of Munitions. The price was then £1,066 per car without electrical equipment; to-day the price is £2,050 per car. This increase of 100 per cent. in cost applies to a large number of articles of equipment which are in regular demand for the maintenance of the undertaking.

INCREASE IN FARES APPROVED.

On February 12 the Council devoted two hours to a discussion of the position of the tramway undertaking. The Tramways Committee recommended an increase in the 1d. fares to 1½d., and this recommendation was approved by the Council with an amendment that the former ½d. fare stages be made 1d. stages and that books of 1½d. tickets be sold.

Sir William Clegg, chairman, moving the adoption of the recommendation, said that the increase was a necessity, for in December last they were working at a loss. In December there was a loss at the rate of £600 per week, and in January at the rate of £700 per week. During the past month to avoid overcrowding they had increased the car service, and there had consequently been a reduction in revenue. Referring to the increased cost of materials, he mentioned that the price of rails had increased from £6 to £17 10s. per ton; cement from £1 14s. to £6 9s. per ton; gear wheels from £3 2s. to £3 15s. per set; oil from 1s. to 3s. per gallon; tickets from 3d. to 1s. 3d. per thousand, while timber had increased 500 per cent. In addition the wages of employees had been increased and shorter hours granted without reduction of pay. The proposed increase in fares would increase the revenue by £188,000, and as the increased expenditure would probably aggregate £135,000, there would be a profit of about £32,000, which he considered a reasonable return on the capital outlay of £1,000,000.

Councillor A. Barton, in moving that the fares should not be increased, said that he could not see why the undertaking should not be subsidised by the rates, for even 6d. in the £ would only make a 1d. on the rent, whereas an increase in the fares would cost much more to the workers. The undertaking had paid £414,000 in relief of rates.

EVOLUTION OF TRAMWAYS.—Mr. F. Bland, of Messrs. Edgar Allen and Company, gave an illustrated lecture on February 24 before the Sheffield Society of Engineers and Metallurgists in the Applied Science Department of Sheffield University, on "The Evolution of the Modern Tramway System." The lecture opened with an account of the earliest attempts at the establishment of a tramway system, commencing with the laying of the lines along the road at the Marble Arch, London, in 1861, and subsequently at Birkenhead. Alluding briefly to the 200 different designs of rails which had been proposed, Mr. Bland showed how these had gradually been reduced to two within 30 years; and then dwelt on the desirability of standardising gauges, cars, etc. In conclusion, he showed various types of the cars now in use on the Continent, in the United States, and in the Dominions.

TRAMWAY AND OMNIBUS EMPLOYEES' DEMANDS.

CONCESSIONS THAT WILL ENTAIL HIGHER FARES.

During the past few weeks representatives of the Municipal Tramways Conference, the Tramways and Light Railways Association, and the National Transport Workers' Federation have held several conferences with the object of reaching an agreement with regard to the demands of the employees. These demands, which have now been somewhat modified, were put forward in December last, and are as follows:—

(1) That the working week shall consist of 44 hours, inclusive of signing on and signing off.

(2) That every employee shall be guaranteed a working week of 44 hours or payment equivalent thereto.

(3) No day's work shall be in excess of eight hours.

(4) In no circumstances shall a reduction in the working day entail a reduction in existing wages.

(5) No spread-over duty shall exceed nine hours, inclusive of meal times or relief.

(6) All national holidays, Sunday, and overtime labour to be paid for at the rate of time and a half.

(7) All employees shall be granted 14 days' holiday annually with pay.

The negotiations, although conducted in a very friendly spirit, have been prolonged and sometimes animated. They have included several discussions with the Minister of Labour, who has been in touch with the proceedings throughout. At the time of writing no definite settlement has been reached, but the prospect of arriving at a mutual agreement which will avoid extreme measures is regarded as encouraging, for at the conference at Manchester on March 7 certain proposals were agreed to by all parties. These proposals will be submitted for ratification at separate meetings of the three bodies to be held during the week ending March 15.

It is understood that the proposals include the concession of a 48-hour week, with wages based on a 57-hour week. This and other concessions will enormously increase the wages bill of the tramway undertakings throughout the country, and will entail a large and general increase in tramway fares, for which the consent of the Government will be necessary.

ALTON AND BASINGSTOKE LIGHT RAILWAY.

Alton and Basingstoke Light Railway, which was one of the earliest promotions under the Light Railways Act, and was constructed by the London and South Western Railway Company, was pulled up during the war and the rails sent abroad. In reply to a question in the House of Commons as to whether the line would be reinstated, Mr. Bridgeman said that the President of the Board of Trade had been in communication with the railway company, and he understood that although they had not yet arrived at a definite decision, they saw no prospect in existing circumstances of the railway being relaid and reopened for traffic in the near future. The general question of improved communication, continued Mr. Bridgeman, was one for the consideration of the Ministry of Ways and Communications when it was established, and in the meantime the President of the Board of Trade could not usefully take any action.

NEW ROLLING STOCK FOR NOTTINGHAM.

Nottingham Corporation Tramways Committee, acting on the advice of the general manager (Mr. J. Aldworth), propose to place orders immediately for 25 new cars at a total estimated cost of about £40,000. These cars will be similar in type to the Nottingham Corporation standard car, which was described and illustrated in our issue of June 11, 1914. Three years ago the committee provisionally ordered a number of new equipments and car bodies to replace those which are worn out, and they hope to obtain delivery of these at an early date. At the present time 17 cars are permanently disabled awaiting the installation of new equipments, and many others require extensive repairs.

HULL TRAMWAYS TO BE EXTENDED.

Hull Tramways Committee have presented a report recommending that the tramways should be carried beyond the city boundaries, and that in any Bill promoted by the Council for the extension of the boundaries to Hessle, Anlaby, Kirk-Ella, Willerby, Cottingham, Preston, and Hedon, powers should be obtained to take the tramways to those places, which are all within a five-mile radius. Steps are to be taken at once to extend the tramways to Newlands Park and Anlaby Road, and over the centre of the city The engineer has been asked to submit a scheme for a tramway along the river front, linking up the docks, quays, and ship-repairing establishments. The views of an outside expert are also to be taken on the Humberside scheme.

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CONTRACTS AND ORDERS.

Mirrlees Watson Company, Limited, are supplying a multi-jector air pump for Pinkston, Glasgow, power station.

Messrs. Ward, Haggas and Smith are supplying a 9½ inch centre lathe at £310 to Bradford Corporation Tramways.

Edison Accumulators, Ltd., have an order from Sheffield Corporation for three 2-ton electric tipping wagons at £1,304.

The British Thomson Houston Company, Limited, have an order from Walsall Electricity Committee for a traction rotary of £3,439.

The British Westinghouse Company are supplying a 3,000 KW turbine, condensing plant, etc., to Stoke-on-Trent Electricity Committee.

Dick, Kerr & Company, Limited, are supplying a turbo-alternator condensing plant and transformer at £133,736, to Glasgow Electricity Committee.

Dick, Kerr and Company, Limited, have received an order for 18 sets of electrical equipment for tramcars from West Hartlepool Corporation.

Hull Corporation has placed an order with Messrs. Youngs, of Birmingham, for a set of hydraulic lifting jacks for lifting tramcar bodies at £285.

Preston Corporation has purchased from Messrs. Hulse and Company, of Salford, a double car-wheel lathe for the car repair shop, the price being £900.

Hurst, Nelson and Company, Limited, of Motherwell, have received an order for ten new tramway car bodies with covers from Dundee Corporation, at a cost of £1,300 each.

The Woods-Gilbert Rail Remodelling Company, Limited, of 170, Strand, London, W.C., are carrying out a contract for remodelling rails on the London United Tramways.

The Brush Electrical Engineering Company, Limited, of Loughborough, have received an order for six bogie type, vestibule front cars and three pairs of maximum traction trucks from West Hartlepool Corporation

The Rail Welding Company, of 119, Victoria Street, London, S.W., are the successful tenderers to Salford Corporation for welding and re-treading 400 joints by the company's electrical process. The value of the contract is approximately £1,000.

Bradford Tramways Committee have recently placed contracts with Dick, Kerr and Company, Limited, for 26 tramway cars with complete equipments, at £1,980 each, and for 52 traction motors, complete with controllers, resistances, and circuit breakers, at £246 each.

Sheffield Corporation have been recommended by the Tramways Committee to accept the tender of the Brush Electrical Engineering Company, Limited, for 50 double deck, top covered, vestibule tramway car bodies and trucks, at £102,500, with 5 per cent. for contingencies.

Manchester Tramways Committee has accepted tenders for the supply of motor trucks, car bodies and rails to the value of £150,000. At a meeting of the committee, Alderman Bowes, the chairman, said that 50 cars were to be erected in the sheds, and 50 to be constructed outside as a first instalment.

J. W. Courtenay, Limited, of Amberley House, Norfolk Street, London, W.C., who for may years have been advertising contractors for the Edinburgh and District Tramways Company, Limited, have now been appointed sole advertising contractors to the Edinburgh Corporation, which will take over the operation of the tramways on June 30, 1919.

Electric Welding Equipment.—In view of the large quantity of rail renewals necessary in the immediate future, the Highways Committee of the London County Council have decided to obtain an electric welding equipment, consisting of a motor generator, switchgear, accessories, and electrodes for the purpose of welding rail joints and making good rail ends which had become worn.

Cardiff Tramways Committee have accepted the following tenders: Boilers, Messrs. Babcock and Willcox, £9,455; feed pumps, Messrs. G. and J. Weir, Glasgow, £370; induced draught plant, Messrs. Musgrave, Belfast, £1,400; steel chimney, Messrs. John Thompson, Dudley, £805; fuel economisers, Messrs. Green and Sons, Wakefield, £1,745; and 4,250 yards of cable from the British Insulated and Helsby Cables Co. at £1,410 per mile.

Messrs. Dick, Kerr and Company, owing to an order being cancelled through the armistice, are in a position to promise delivery to Leicester Corporation of a complete 5,000 kilowatt unit in four and a half months at the price of £82,000. This plant is required at the Aylestone Station in order to deal with the extra load for the next two or three years. At the end of that time it is proposed to remove the plant to a new station to be erected at Freeman's meadow as recommended by Mr. C. H. Wordingham in 1917. Owing to war conditions the Board of Trade refused to sanction an application for a loan to purchase the land, etc., and the Tramways and Electricity Committee intend to recommend the Corporation to renew the application.

PATENT LIST.

Abstracted for "The Tramway and Railway World" from the Official Journal of Patents.

***** If the inventions have been communicated the names of the communicators are given in italics.**

APPLICATIONS FOR LETTERS PATENT.

The number of the patent is given in brackets.

Mechanically propelled road vehicles (2,084)—H. W. Alexander.
Automobile road wheels of the sheet metal type (2,292 and 2,418)—Sir H. Austin, Austin Motor Company, A. J. McCormack and Wolseley Motors, Limited.
Trolley pole heads, pulley brackets, etc. (2,212)—A. Bannister and T. W. Tucker.
Motor vehicles (2,489)—E. H. Belden.
Driving and reversing mechanism for motor vehicles (1,969)—W. Bell.
Motor vehicles (2,111)—M. Birkigt.
Change gear boxes for internal combustion motor vehicles (2,206)—D. C. Black.
Variable speed device (2,415)—G. Cookson and W. J. Willmoth.
Side tipping apparatus for motor lorries, trailers, etc. (2,554)—B. W. Coopey.
Means for adapting wheeled vehicles to travel on road or rail (2,048)—E. Culpan.
Suspension of trolley wires of electric railways, etc. (1,984)—P. Dawson and F. W. Fawdry.
Supporting device for electric trolley wires (1,985)—P. Dawson and F. W. Fawdry.
Suspension of conductor wires on electric railways, etc. (1,986)—P. Dawson and F. W. Fawdry.
Mud splashing preventer for motor vehicles (2,277)—J. W. Goddard and S. W. Hazeldine.
Steering apparatus for vehicles (1,938)—J. G. Gray.
Friction driving gears for motor cars (2,082)—A. G. Grice.
Jacks for automobiles (2,364)—Michelin et Cie.
Air operated lifting jack (2,564)—J. M. Miles.
Variable speed transmission gear (2,220)—H. Newbold.
Tramway signal (1,950)—C. H. Oldham.
Sleepers for permanent way (2,591)—C. P. Sandberg.
Change-speed gears (2,079)—A. Le G. Southwell.
Variable speed mechanism (2,054)—E. Whiteley and R. Whiteley.
Driving wheels, steering and transmission gear for motor vehicles (2,452)—H. S. Wonham.
Locking device for steering wheel of motor car, etc. (2,822)—M. Chapman and Company and J. K. Ovenstone.
Resilient tires for wheels of motor vehicles (2,981)—T. J. R. Clarkson.
Gear boxes for motor vehicles (3,032)—J. C. Moore.
Direction indicator for vehicles (2,982)—S. G. Mould.
Bonnet locking device for motor vehicles (3,166)—W. T. Osborne and A. Smith.
Railway and tramway wheels (3,096)—Owen and Dyson and A. O. Peech.
Current collectors for street cars (3,168)—A. B. Upham.
Appliances for prevention of skidding for motor omnibuses (3,184)—J. H. Allum and H. J. Loveday.
Motor car radiators (3,793)—T. Antoine.
Rigid coal gas containers for compressed gas for motor vehicles (3,646)—E. J. Buckingham.
Coal-gas carburetter for motor cars, etc. (3,647)—E. J. Buckingham.
Automobile internal combustion engines (3,473)—A. C. Butcher and J. Tylor & Sons.
Change-speed gears (3,257)—J. Carey.
Braking systems (3,656)—A. de Coninch.
Underframes for automobiles (3,574)—A. de Coninch.
Safety appliances or guards for motor vehicles (3,801)—J. Cooke and W. C. Croxon.
Spring suspension of motor vehicles (3,713)—L. E. Cowey.
Signalling device for road vehicles (3,297)—A. Cox.
Device for preventing slipping of motor car wheels on snow, etc. (3,229)—A. B. Crowhurst.
Splash-guards for wheels of motor vehicles (3,774)—E. J. Dexter.
Attachment to trolley of electric tramways, etc., for replacement of trolley on the wire (3,761)—T. Forsyth.
Signalling apparatus for road vehicles (3,652)—H. Fryman.
Radiators for cooling on motor cars, etc. (3,478)—E. C. Gilbody.
Shock absorbers in motor vehicles (3,759)—J. P. MacLean.
Electric tramcar apparatus (3,218)—K. Matsumoto.
Change-speed gearing (3,342)—J. F. Morfoot.
Electric locomotives (3,701)—G. Pestarini.
Lifting jacks (3,543)—G. R. Phipps.
Railway and tramway vehicles (3,402)—J. H. Satchell and W. S. Sommers.
Means for retaining wheels on live axle motor vehicles, etc. (3,796)—T. Thornycroft and J. I. Thornycroft and Company.
Coal gas producing plant for motor vehicles (3,633)—C. J. Waldie.
Universal joints for motor vehicles, etc. (3,729)—F. J. Willmott.
Device to protect controller and motors on electrically propelled vehicles (3,841)—G. C. Adams.

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Motor cars (4,446)—R. W. Anderson.
Transmission systems for motor vehicles (4,028)—J. Bell.
Driving gear of motor vehicles (3,824)—J. L. Hamilton-Blackwood.
Change-speed mechanism (4,031)—A. Boerner.
Fittings for suspension of trolley wires in overhead wire systems of electric traction (4,196)—Brecknell, Munro and Rogers and A. M. Willis.
Compressed air brake apparatus (4,022 and 4,023)—British Air Brake Company and J. W. Cross.
Change speed gears (4,284)—C. Bugaud.
Change speed gears for motor vehicles (4,255)—F. Butler.
Rear signalling devices for road vehicles (4,363)—A. Cairns.
Differential gear for motor vehicles (4,199)—R. Carter.
Diminution of wear of railway rails and wheels (4,171)—H. B. Clapp.
Variable speed gearing (4,074)—I. Cohen.
Means for guiding wheels of trolley heads into overhead wires (3,895)—P. A. Craven.
Rails and accessories (4,212)—W. E. Davies and G. Simoens.
Change speed gearing (4,298)—H. C. Blanc-Garin.
Mechanical device for variable speed transmission (4,341)—T. Humphreys.
Electro-mechanical device for variable speed transmission (4,342)—T. Humphreys.
Variable speed gears for motor cars (4,475)—G. H. Jones.
Power transmission devices for motor cars (4,122)—A. J. MacKay.
Road wheels for motor, etc., vehicles (4,197)—H. S. Morgan and R. E. Morgan.
Rail saving and drilling apparatus (4,024)—W. H. Morton.
Motor vehicles (4,070)—J. Newton.
Self-propelled vehicles (4,447)—T. A. Petrie.
Variable speed gearing for motor vehicles (4,142)—J. E. Preston.
Trolley wheel mechanism of overhead electric systems (4,192)—H. V. Richardson.

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Life guards, brakes, clutches, control arrangements, etc., for power vehicles (4,332)—D. Roche.
Chairs for securing double champigon rails to metal sleepers (3,973)—Soc. Anon. d'Ougrée-Marihaye.
Automobile steering axle and gear (4,248)—W. L. Spence.
Switch apparatus for ignition circuit of automobile (4,176)—E. Tonks and Sons.
Reduction of distortion of electric signalling currents (4,065)—Western Electric Company (*Western Electric Company*).
Mechanical device for variable speed transmission (4,341)—H. H. Wright.
Electro-mechanical device for variable speed transmission (4,342)—H. H. Wright.

SPECIFICATIONS PUBLISHED.

1917.

Shock-absorbing mechanism for use in the suspension of vehicles (16,026—*121,763*)—G. E. Stanley.
High-pressure gas system for motor road vehicles (16,401—*121,764*)—G. H. Robinson.
System of springing automobile vehicles (16,462—*121,765*)—F. W. Lanchester.
Springing of road or rail vehicles (17,027—*121,767*)—F. W. Lanchester.
Railway sleepers (19,297—*121,792*)—W. A. Lockard.
Friction clutches and friction brakes (16,033—*121,981*)—Lancashire Dynamo and Motor Company and H. B. Whitmore.
Wheels for motor vehicles (18,091—*121,988*)—W. L. Bodman.
Automatic signalling devices for attachment upon vehicles (18,173—*121,989*)—T. D. Joeck.
Condensers or radiators for motor road vehicles (19,144—*121,997*)—T. Clarkson.
Lifting jacks for use on motor road vehicles (18,739—*122,216*)—F. L. Rapson.
Stopping and turning indicators for vehicles (12,635—*122,429*)—W. S. Shephard.

1918.

Gas storage reservoirs for use on motor propelled vehicles (108—*121,811*)—E. G. E. Beaumont.
Gas supply apparatus for motor vehicles (274—*121,821*)—H. F. Mordey, F. Mansfield, P. H. Houghton, and W. Lane.
Hydraulic lifting jacks (3,442—*121,860*)—Tangyes, Limited, and E. Johnson.
Electro-mechanical power transmission system (4,131—*121,870*)—Leyland Motors, Limited, and J. G. P. Thomas.
Variable speed forward and reverse gear (5,355—*121,883*)—H. S. Wonham and H. W. Walker.
Radiators used for cooling purposes in connection with the power plant on motor cars (8,987—*121,905*)—E. C. Gilbody.
Carburetters or apparatus for mixing any desired proportion of air with gas or vapour applicable for use on motor cars employing coal gas (301—*122,004*)—B. J. V. A. Flugel and H. F. Webb.
Steering mechanism for motor vehicles (448—*117,802*)—E. H. Belden.
Gas-holders for use on motor vehicles (674—*122,032*)—J. C. Watson.
Street cars (9,809—*122,122*)—A. L. W. Begg.
Bonnets of motor car engines (10,356—*122,127*)—R. Lamb.
Steering gear for motor vehicles (1,194—*122,259*)—J. W. Mackenzie (*F. de S. Carrico and H. S. Hall*).
Means of adjusting track points (2,623—*122,292*)—J. Murray.
Apparatus for change speed of a motor car (13,297—*119,858*)—S. Tamura and M. Watanabe.
Lifting jacks for motor vehicles (19,703—*122,389*)—F. L. Rapson.
Power transmission mechanism (1,006—*122,422*)—P. S. Crowsley.
Railway tie-bars (1,385—*122,480*)—W. A. Campbell.
Variable speed gears (3,037—*122,522*)—B. W. B. Puckle.
Driving and controlling device for automobiles (3,642—*122,530*)—H. G. C. Fairweather (*A. Leffler*).
Jacking apparatus for motor vehicles (3,861—*122,535*)—T. Glover.
Automatic apparatus for lubricating railway and tramway track wheels and rails (20,179—*121,601*)—A. Hofmann.

MUNICIPAL TRAMWAYS ASSOCIATION.

Appointment of General Secretary.

Applications are invited for the position of secretary to the above Association.

The gentleman appointed will be required to devote the whole of his time to the duties of the office. Requisite office accommodation and staff will be provided. Salary according to qualifications and experience, but in any case not less than £750 per annum.

Applications, stating age, experience, and qualifications, should be forwarded to the undersigned not later than Monday, the 24th instant.

Tramway Offices,
32, Blackfriars Street,
Salford.

G. W. HOLFORD,
Hon. Secretary.

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TRAFFIC RETURNS.

Tramway and Omnibus Undertakings in the United Kingdom.

NAME OF COMPANY OR CORPORATION.	1918. WEEKS ENDED.					1919. WEEKS ENDED.					AGGREGATE.		
	Feb. 2	Feb. 9	Feb. 16	Feb. 23		Feb. 1	Feb. 8	Feb. 15	Feb. 22		Wks.	1919.	Increase or Decrease.
	£	£	£	£	£	£	£	£	£	£		£	£
Aberdare U.D. Council	493	492	491	466	...	522	503	470	473	...	46	23,481	—
Aberdeen Corporation	2,262	2,315	2,167	2,134	...	2,482	2,515	2,390	2,448	...	38	98,666	+ 16,337
Ayr Corporation	337	329	325	331	...	391	391	397	387	...	40	23,828	+ 4,952
Belfast City	...	...	...	...	...	...	...	...	...	...	—	—	—
Birkenhead Corporation	1,851	1,885	1,931	1,943	...	2,054	2,022	1,946	2,058	...	47	102,406	+ 15,353
Blackburn Corporation	1,638	1,570	1,453	1,444	...	1,588	1,620	1,685	1,662	...	47½	83,061	+ 12,869
Bradford Corporation	7,226	7,018	7,432	7,987	...	9,072	9,064	8,583	9,190	...	47	434,765	+ 75,339
Burnley Corporation	1,938	2,023	1,977	1,957	...	2,484	2,616	2,596	2,583	...	—	—	—
Burton-on-Trent Corporation	376	386	377	370	...	399	395	382	415	...	47	19,413	+ 4,142
Bury Corporation	1,585	1,551	1,649	1,612	...	1,935	1,947	1,962	1,982	...	47	95,820	+ 18,666
Chatham and District	1,114	1,163	1,227	1,090	...	1,175	1,086	1,097	1,143	...	7	8,432	+ 131
Cork Electric	573	585	604	587	...	525	529	526	532	...	7	3,907	— 277
Derby Corporation	1,306	1,251	1,292	1,257	...	1,403	1,402	1,401	1,423	...	47	70,194	+ 12,721
Dundee City	1,564	1,723	1,729	1,537	...	1,982	1,956	1,949	1,896	...	40	78,223	+ 15,511
East Ham Corporation	1,333	1,333	1,357	1,230	...	1,468	1,590	1,531	1,505	...	46½	73,455	+ 9,430
Glasgow Corporation	26,610	26,754	26,278	26,957	...	27,868	27,418	26,490	27,077	...	38½	1,089,536	+ 82,640
Glossop (Urban Elec. Supply Co.)	181	181	180	188	...	211	206	202	229	...	8	1,660	+ 242
Halifax Corporation	2,316	2,109	2,164	2,279	...	2,668	2,629	2,531	2,506	...	46½	130,524	+ 17,668
Halifax Corp. Motor Omnibuses	53	48	53	52	...	68	66	63	65	...	46½	3,107	+ 814
Huddersfield Corporation	3,143	3,119	3,309	3,577	...	3,528	3,548	3,353	3,511	...	47	170,154	+ 21,236
Ilford U.D. Council	...	...	789	745	...	...	...	954	989	...	47	47,111	+ 11,346
Ipswich Corporation	575	600	614	608	...	604	639	653	658	...	47	34,850	+ 3,762
Isle of Thanet	200	200	187	170	...	257	257	309	274	...	20½	6,340	+ 2,752
Kilmarnock Corporation	224	217	221	226	...	265	275	263	265	...	40½	10,811	+ 2,433
Lanarkshire	2,952	3,137	3,210	3,314	...	3,595	3,480	3,380	3,374	...	7	26,813	+ 4,365
Lancashire United	...	...	...	...	...	...	...	...	...	...	—	—	—
Leeds City	10,728	10,830	11,373	11,030	...	13,734	13,647	13,243	13,464	...	47	635,590	+ 119,083
Leicester Corporation	4,215	4,285	4,187	4,174	...	4,863	4,743	4,743	4,812	...	—	—	—
Leyton U.D. Council	1,744	1,735	1,862	1,641	...	2,376	2,292	2,413	2,368	...	47	111,528	+ 23,884
Liverpool Corporation	16,689	16,644	16,583	16,667	...	19,361	19,244	18,762	19,438	...	7½	148,128	+ 23,712
Llandudno and Colwyn Bay	236	253	242	249	...	267	290	284	288	...	12	3,510	+ 746
London County Council	53,718	52,780	56,201	51,918	...	66,553	66,271	67,317	64,025	...	46½	3,081,229	+ 523,011
Maidstone Corporation	247	243	247	232	...	261	245	258	265	...	46½	13,255	+ 1,732
Manchester Corporation	23,576	23,080	23,468	23,546	...	26,478	27,757	26,500	26,322	...	47	1,228,089	+ 233,683
Newcastle-on-Tyne Corporation	8,454	8,447	8,593	8,480	...	8,145	7,840	7,685	7,730	...	47	416,306	+ 45,087
New St. Helens and District	...	...	...	...	...	...	...	...	...	...	—	—	—
Northampton Corporation	866	923	895	882	...	957	950	932	972	...	41	41,749	+ 1,976
Nottingham Corporation	4,943	4,740	4,824	4,706	...	5,832	5,813	6,274	6,202	...	47	270,646	+ 59,416
Oldham Corporation	...	...	...	...	...	...	...	...	...	...	—	—	—
Reading Corporation	1,065	1,109	1,166	1,121	...	1,247	1,233	1,237	1,309	...	46½	60,603	—
Rhondda Tramways	1,650	1,582	1,591	1,560	...	1,997	1,907	1,929	1,999	...	7	14,733	+ 3,627
Rotherham Corporation	1,948	2,053	2,002	2,051	...	1,971	1,987	1,917	2,071	...	47½	108,133	+ 20,663
Sheffield Corporation	12,851	12,933	13,190	13,098	...	12,368	12,529	12,248	12,347	...	47½	631,416	+ 48,299
Southampton Corporation	2,230	2,242	2,292	2,176	...	2,197	2,135	2,193	2,173	...	46½	116,736	+ 19,559
Southend-on-Sea Corporation	674	671	711	625	...	1,032	969	1,020	1,022	...	47	60,948	+ 20,139
South Shields Corporation	...	...	1,036	...	...	...	...	1,131	...	...	46	52,960	+ 8,639
Sunderland Corporation	1,933	1,985	2,001	2,029	...	2,344	2,341	2,536	2,625	...	47	103,887	+ 16,092
Swindon Corporation	282	288	292	287	...	282	198	276	282	...	46½	14,237	+ 1,471
Torquay Tramways	703	657	653	657	...	657	608	689	628	...	7	5,041	+ 315
Tyneside Tramways and Tramroads	879	848	...	...	...	797	785	...	...	...	6	4,238	+ 84
Wallasey Corporation	1,437	1,430	1,456	1,458	...	1,879	1,848	1,774	1,840	...	46½	88,111	+ 14,660
Walsall Corporation	1,079	1,112	1,082	...	...	1,211	1,202	1,202	...	...	49	57,053	+ 10,850
Walthamstow U.D. Council	1,096	1,170	1,186	1,094	...	1,252	1,252	1,307	1,306	...	47	67,253	+ 10,269
Warrington Corporation	742	752	759	744	...	837	826	803	815	...	47	36,572	+ 8,396
West Ham Corporation	3,534	3,551	3,736	3,377	...	4,478	4,445	4,535	4,637	...	46½	213,917	+ 43,204
Wigan Corporation	...	...	...	...	...	...	...	...	...	...	—	—	—

*** A number of undertakings have suspended the issue of traffic returns for the duration of the war.

Colonial and Foreign Tramway Traffic Returns.

NAME OF COMPANY.	1918. WEEKS ENDED.					1919. WEEKS ENDED.					AGGREGATE.		
	Feb. 2	Feb. 9	Feb. 16	Feb. 23		Feb. 1	Feb. 8	Feb. 15	Feb. 22		Wks.	1919.	Increase or Decrease.
	£	£	£	£	£	£	£	£	£	£		£	£
Anglo-Argentine	50,620	55,428	53,304	54,377	...	58,942	60,269	57,780	58,997	...	8	428,987	+ 5,843
Calcutta Rs.	71,333	72,140	71,419	72,650	...	82,762	85,090	88,182	87,371	...	7½	657,946	+ 104,540
Madras Rs.	...	(2 weeks)	37,363	...	...	...	(2 weeks)	43,299	...	...	6	131,355	+ 15,714
Pernambuco	4,759	4,759	4,927	4,438	...	5,497	5,397	5,098	4,879	...	7½	40,496	+ 2,867

Companies issuing Monthly Statements only.

	1917.				1918.		1918.				1919.		Wks.	AGGREGATE.	
	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.		1918-19.	+ or −.
	£	£	£	£	£	£	£	£	£	£	£	£		£	£
Ballarat & Bendigo	3,072	3,546	3,405	3,228	4,505	...	3,430	3,690	3,570	3,884	4,504	...	40	35,478	+ 2,167
Brazilian Trac. Mlrs	7925000	8006000	7695000	...	...	...	9081000	8052000	7581000	...	...	...	47	93,363,000	+ 9,232,000
Brisbane	31,600	33,580	32,901	35,019	34,500	...	35,400	36,780	39,246	38,135	38,575	...	4	38,575	+ 4,075
British Columbia	$457,709	491,964	525,629	555,555	559,569	...	575,476	580,354	612,893	691,065	667,489	...	30	4,095,584	+ 612,355
Buenos Ayres L'c'z.	33,655	39,067	39,678	40,901	38,902	...	41,006	41,843	42,952	50,460	41,556	...	30	300,780	+ 31,403
Burma	26,167	28,955	27,760	26,224	25,430	...	30,836	34,848	34,407	34,593	38,265	...	26	214,804	+ 53,554
Cape Town	...	17,128	16,522	...	...	...	17,872	13,877	18,385	...	...	...	—	—	—
Carthagena & H.	4,306	2,805	3,932	4,424	4,011	4,031	2,549	2,525	2,988	2,950	3,655	2,351	8	6,006	− 2,036
Cordoba	...	...	...	...	...	...	...	...	...	...	...	...	—	—	—
East India	1,512	1,229	871	1,099	1,176	...	1,939	2,044	1,947	2,048	1,970	...	26	11,923	+ 4,474
Kalgoorlie	3,063	2,795	...	...	...	...	2,947	2,835	...	...	...	...	43	27,905	+ 982
La Plata	3,450	4,069	3,742	4,606	4,711	4,746	4,999	5,177	5,334	5,792	5,730	5,698	8	11,428	+ 1,971
Lima	35,636	37,612	37,249	43,198	...	...	42,861	45,336	44,948	47,887	...	...	52	527,839	+ 87,587
Mamos Rs.	...	...	...	...	...	...	...	...	...	...	...	...	—	—	—
Manila	$152,200	157,400	159,000	...	...	...	204,500	214,898	214,292	...	...	...	48	2,090,630	+ 466,897
Monte Video	29,426	30,153	...	34,025	36,016	34,573	...	33,203	...	38,441	40,910	38,772	17	149,821	+ 14,147
Peruvian	$950,740	1047220	899,680	1101090	1189350	...	957,910	1090815	897,090	1057990	1009650	...	30	7,030,365	− 247,255
Para	...	...	...	23,315	24,060	...	...	...	...	23,800	24,515	...	8	48,315	+ 940
Port Elizabeth	...	3,885	3,807	...	...	...	3,661	2,751	3,498	...	...	...	—	—	—
Rangoon	5,163	5,667	5,358	5,438	5,361	...	6,067	6,566	6,611	6,188	6,373	...	4	6,373	+ 1,012
Toronto	$1023517	1043886	1052000	...	1068319	...	1119925	1048478	1071106	...	1106840	...	4	1,106,840	+ 38,521
Winnipeg	$267,170	301,772	305,881	...	334,642	...	285,670	295,005	283,721	...	390,539	...	4	390,339	+ 55,897

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The Daimler Two-Tonner sets the standard for Commercial Motor Vehicles

"AS good as a Daimler" is a well-known phrase of recommendation.

The reliability of Daimler Commercial Vehicles is an axiom in motor transport circles, and their cost of maintenance is the lowest known.

The Daimler is not the only serviceable lorry on the road, but however good other vehicles may be they must all fall short of Daimlers in relation to engine performance and continuity of service.

The Daimler standard of efficiency is only within the scope of the Daimler Sleeve-Valve Engine.

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TWO MODELS

To Carry 30/45 cwt. & 3½ tons Respectively

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RAILWAY GAZETTE, March 31, 1916.

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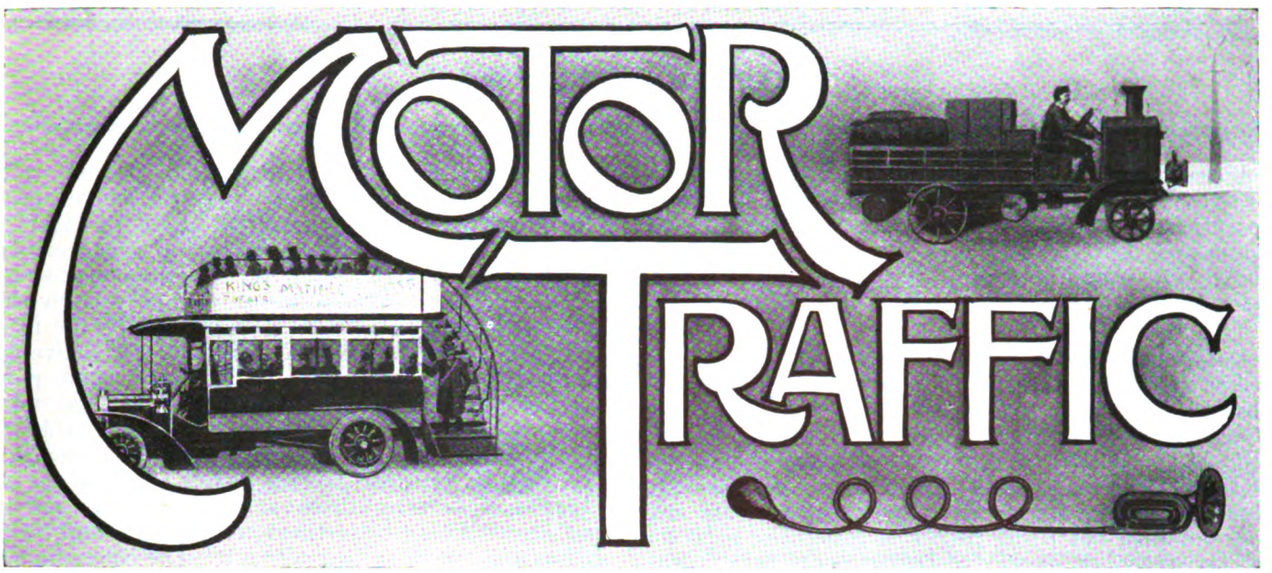

MOTORISTS DEMAND A SEPARATE MINISTRY FOR ROADS.

During the past few weeks a very wide and powerful opposition has been organised to the intention of the Government that the new Ministry of Ways and Communications should absorb the Road Board and its functions. The opponents, taking a somewhat sectional view of the matter, demand a separate Ministry for roads. The Automobile Association and the Society of Motor Manufacturers and Traders have collaborated to form a body known as the Motor Legislation Committee, which has very considerable funds at its disposal, and is engaged in active propaganda and organisation which for the moment is concentrated on the question mentioned above. The Parliamentary Committee of the R.A.C., though not definitely collaborating with this new body, is at one with it on this particular question of policy. So also is the Federation of British Industries, which has very wide interests that cannot be accused of bias in favour of any one system of transport, and should be able to get a good hearing for its views. In the House of Commons itself a Road Transport Committee has been formed. This Committee has elected a strong Executive, and has appointed Mr. Joynson Hicks to act as its chairman. It is stated that the Committee now numbers more than two hundred Members of Parliament, and that it will actively oppose any attempt to include the control of roads in the powers of the new Ministry. Possibly by the time these notes appear in print matters will have progressed very much further. At the moment it is impossible to see what will be the final arrangement reached. It is conceivable that in some form the Road Board may be allowed to continue an independent existence, but if the Government adhere to their present intention the opposition should at least be strong enough to ensure the introduction of such safeguards as will effectually protect the future of roads and road transport.

SALE OF SURPLUS MOTOR VEHICLES.

Several steps have been taken in the direction of the solution of the surplus vehicle problem since we last made reference to it. For months, and even years, motor manufacturers, retailers, and users who desired to see this problem properly solved were to all intents and purposes unable to produce any results because there really existed within the Government no organisation competent to take executive action. The consequence was much talk but nothing done. Sooner or later, of course, it had to be realised that it was impossible to let the matter stand over indefinitely. The whole question of the disposal of surplus Government stores was then referred to the Ministry of Supply, formerly the Ministry of Munitions. A new and improved Surplus Government Property Disposal Board was set up to act as a supreme direction body. Within the Ministry there were constituted a number of Executive Departments, each one charged with the work of disposing of stores of a certain class. It is not, however, left to the Executives to determine the method of disposal. In conjunction with each Executive there has been formed an Advisory Committee so constituted as to include representation of the interests most deeply affected. This Advisory Committee makes recommendations on all matters of general principle. Presumably these recommendations will in nearly every instance be endorsed by the Board, and the Executive Departments instructed to act upon them. In the particular section that concerns us, the Executive Department is under the charge of Colonel Holbrook, Director of Mechanical Transport, who has shown himself a very competent organiser. The Advisory Committee includes Mr. H. C. B. Underdown, the president of the Association of British Motor and Allied Manufacturers; Mr. L. Walton, representing private car manufacturing interests; Mr. Mobbs, representing the retailers; Mr. Orde, of the R.A.C., and other names well known in the motoring community. It may fairly be assumed therefore that this Advisory Committee will not come to any unanimous resolutions of a kind likely to jeopardise unduly the interests of the motor industry and trade, or the ability of motor manufacturers to face the very difficult problems of the future connected with the employment of labour. The bulk of the surplus vehicles awaiting disposal consists of substantial motor lorries. These may be divided into three big groups. The first consists of new vehicles that have never seen service; the second of vehicles of modern type that have seen service but are still in good workable condition; the third of vehicles of obsolete type, together with vehicles of more recent type, the condition of which is such as to render very comprehensive repairs necessary, if repairs are justifiable at all. In some ways the problems of the new vehicle and of the very old vehicle present fewer difficulties than the main problem of the serviceable vehicle. With regard to the last-named, we have the big question of whether the

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MOTOR TRAFFIC

vehicles should be repaired before any attempt is made to sell them, and if so, whether the repairs should be entrusted to the original manufacturers. The Advisory Committee has not yet been sitting long enough to evolve any complete scheme, but we learn that considerable progress is being made.

A RESEARCH ASSOCIATION FOR THE MOTOR INDUSTRY.

The motor industry will, unless some unexpected obstacle interferes, soon be in possession of its own Research Association, able to operate with considerable funds and with the assistance of a valuable measure of Government support. The existence of a general Research Association of the industry does not in any way diminish but really rather increases the need for the existence of Research Departments within the organisations of individual firms. Co-operative research must be on broad lines, aiming mainly at the establishment of general principles, the conduct of lengthy and expensive investigations beyond the power of an individual, the examination of properties of special alloys and materials, and so on. When the general research has established its principles or given exact knowledge of the qualities of certain materials, then it is for each manufacturer severally to apply the information thus gained to his own advantage. This means specific research bearing directly upon design. Without individual effort the results of co-operative research must necessarily be very limited. With it they should be at least considerable. It is, of course, conceivable that they may be actually revolutionary. Thus the conduct of an investigation lasting perhaps for three years, and involving an expenditure of five thousand pounds per annum, would probably be regarded by a single firm as uncommercial, especially if direct results could only be looked upon as a doubtful possibility. Thus the scheme of co-operative research encourages the conduct of work which would otherwise never be undertaken at all, and it is by no means impossible that such work may lead to discoveries of the highest value, having an incalculably beneficial effect on vehicle design. We hope that the Research Association will be well supported by the industry, because through its agency British manufacturers have an opportunity of making exceptional progress calculated greatly to strengthen their position in international markets.

ENCOURAGEMENT OF OVERSEAS TRADE.

It has been evident for some time past that there would be great difficulty in finding markets for the much enlarged output of the British motor industry unless something tangible were done to encourage the overseas demand. In some quarters British manufacturers have been criticised for an apparent lack of interest in this important matter. It is evident that the subject has been receiving very careful consideration, since we are now informed that the industry is sending out a commissioner to make a special study of certain of the more promising markets, and to endeavour to establish closer and more friendly relations between the industry at home and the possible client abroad. The commissioner has already left this country, and his tour will embrace India, Ceylon, Burma, Malaya, Siam, China, Japan, Australia, and New Zealand. The direct and immediate results of an investigation of this kind should be well worth having, but it is to be hoped that the move means something more than is apparent upon the surface, and may lead to the establishment of some concrete organisation enabling the interests of the motor owner overseas to be better watched and served by the manufacturer at home. In the past one of the main grievances has been connected with delays in deliveries, and particularly as regards the supply of spare parts urgently needed. Doubtless many of the larger firms are now taking steps to remedy any such faults in their organisation, but it would certainly seem that there will in any case remain plenty of scope for co-operative action by those who, for one reason or another, would not be justified in creating a world-wide organisation on their own account. The commissioner has the active support of the Overseas Trade Department of the Government, and should thus be in a position to get a hearing for any views that he may be instructed to put forward. It is conceivable therefore that his tour may lead to acceleration in the progress of road construction in some parts of the world. It may be a good thing to have motor vehicles to travel where roads do not exist, but it is a still better thing to have a good road system on which any well constructed vehicle can work with the maximum of efficiency and economy.

ROAD PROJECTS AND OMNIBUS TRAFFIC.

FROM A CORRESPONDENT.

The conditions under which motor omnibuses shall be permitted to use the roads has been a subject of fierce controversy from the time that such vehicles commenced to run. This controversy, unfortunately, tends to become more, rather than less, acute as time goes on. It cannot be helped, for the simple reason that the question does not stand alone, but is bound up very intimately with another and much wider issue, in itself a subject of lively and indeterminate debate.

Until you have settled the great question of the roads, the standard to which they are to be built, their administration and finance, as a whole it is impossible to lay down any general rules as to the terms upon which omnibus enterprise should be allowed to operate as regards liabilities for wear and tear of the highways. The position created by the Local Government (Emergency Power) Act is not a very satisfactory one. It certainly is not ameliorated by the recommendation made by the Select Committee on Heavy Motor Traffic that its provisions as regards the powers of local authorities to impose contributions upon omnibus enterprise for road maintenance should be made permanent. The only reasonable ground on which this contribution—which has become more or less standardised at ½d. per omnibus mile—can be levied is that it represents the approximate extra expenditure likely to arise on account of the use of the roads by omnibus traffic as compared with the normal previous cost. The mere adoption of this arbitrary standard rate is enough to render it suspect in principle. But the powers of veto conferred by the Emergency Act give to local authorities this instrument of pressure upon those wishing to establish omnibus services on new routes, and in practice its operation is hardly distinguishable from blackmail. In any event, the basis of the contribution is illogical and unfair, and the fact that whether it is levied or not is a matter of local prejudice only serves to emphasise these characteristics.

The whole subject of motor transport in its relation to roads and road reconstruction, and the extent to which it should be called upon to share in the cost thereof, is now in process of consideration, and for that reason alone no attempt should at present be made to stabilise the conditions to apply to omnibus traffic apart from the rest. It may be decided to levy a general tax upon heavy motor vehicles. To this tax omnibuses would be liable, and if the provisions of the Act of 1916 be retained they would be in the position of paying twice over for the right to use the roads. But even in the absence of any such general impost, the justice and the expediency of taxing omnibuses specially is open to serious question—at all events as a permanent measure.

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Where the needs of a locality are so far developed as to call for the establishment of a regular omnibus service, it may be taken for granted that there will be an appreciable amount of heavy motor traffic there too. This degree of development, and this traffic, will sooner or later make it incumbent upon the local authority to bring its roads up to the standard suitable for such traffic. This obligation upon a local authority of keeping its roads in a state fit to bear the traffic that may reasonably be expected upon them has virtually the force of law. Where roads are suitable for heavy traffic omnibuses do them no harm. The experience of some of the London boroughs has clearly established this to be the case. On the other hand, where roads are not for the time being of a standard capable of bearing other than comparatively light traffic, the mere fact that new omnibus services are required to run over them is a precedent to conditions in which the necessity of making them fit for heavy self-propelled vehicles. In practice omnibus traffic rarely stands alone. It is certain to be accompanied sooner or later by other heavy traffic, the total volume of which will considerably exceed that of the omnibuses. Yet the latter only, under the Emergency Act and its proposed continuance, are to be locally taxed in respect of road maintenance, while the miscellaneous traffic goes free.

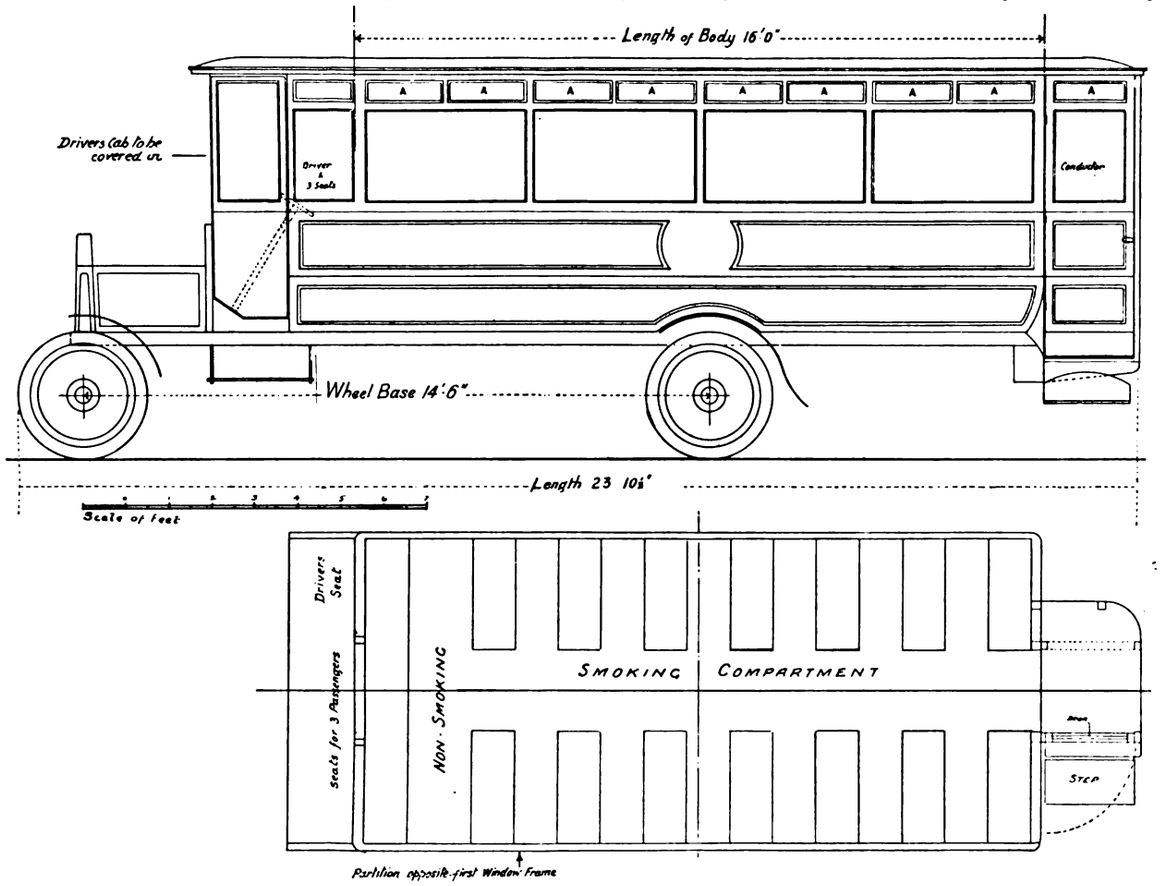
It may be desirable to give local authorities the right to determine, within limits, whether certain kinds of traffic shall or shall not run over certain roads within their jurisdiction, and their licensing powers must obviously remain. But the whole question of heavy traffic and the roads, and of special taxation, should be dealt with nationally and not locally. If in our national reconstruction programme we decide on a standard of main road construction that will be fully adequate for heavy motor traffic, it follows that all roads scheduled as "main" will be fit to carry omnibus services without special damage, and therefore the need to impose special maintenance contributions will disappear. This would leave only a comparatively small mileage of secondary roads carrying omnibus traffic, as to which a case for temporary contributions might exist until such time as these roads were promoted to the category of main roads with the corresponding higher standard of construction. To this extent the principle of the ¾d. per mile might perhaps be retained, but its retention indefinitely can hardly be defended.

LIVERPOOL'S NEW OMNIBUSES.

SPECIFICATION OF VEHICLES TO BE SUPPLIED BY THE A.E.C.

With so many Corporations desiring to purchase motor omnibuses, the design adopted by the Liverpool Corporation Tramways department for 60 single-deck omnibuses that have been ordered from the Associated Equipment Company, Limited, are of special interest. By the courtesy of the general manager (Mr. C. W. Mallins) of the Liverpool Corporation Tramways, we are enabled to give some particulars and a plan and side elevation of these omnibuses, which, as will be seen, embody several novel features.

Exclusive of rear platform and the driver's compartment, the length of the body is 16 ft. and the wheel base 14 ft. 6 in. The driver's enclosed compartment is provided with high front side doors, with slam lever locks and top triggers. The door to the rear end is at the near side, fitted with slam lever locks, with outside and inside brass handle. The window fitted to this door is made to drop when required. When the door is required to be kept open it will be held in position with a spring catch. The double steps to the driver's seat and the rear end of body will be covered with linoleum and fitted with iron tread plates.



Plan and Elevation of Omnibuses now being Constructed for Liverpool Corporation by the Associated Equipment Company.

The front of the body over dash is to be panelled up, with two fixed lights on each side, and in the centre a glass screen to be supplied, divided into four, the off-side top portion of screen (in front of driver) to be fitted with brass joints, the top part made to swing outwards; all this framing to be in mahogany, stained and polished. In the interior the body is to be finished off in natural wood, varnished, including the roof. For lighting, the two head, two side, and two tail lamps, six lamps inside the body, and two lamps over the destination boards, front and rear, will derive current from a C.A.V. dynamo electric lighting 12 volts set, and large 12-volt batteries, fitted in a box at side of the body. An electric bell will enable the conductor to communicate with the driver.

The Tylor engine will be of four cylinders, 5-in. bore by 6-in. stroke, developing 45 B.H.P. at 1,000 revolutions per minute; fitted with Thomson-Bennett magneto and Acme carburetter; pump circulation and pressure-feed lubrication. The aluminium cone

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clutch will be of large diameter, with Ferodo liner and encased volute spring, the thrust being self-contained when clutch is in. The clutch operating gear will be a standard type pedal shaft mounted on spherical bearings to ensure easy operation. The four-speed and reverse speed gear will be contained in a box of very stiff construction, the gears being of the highest quality steel and fitted with ball bearings throughout. The gate change-speed gear is of the selector type, with pedal operated reverse safety catch, the change-speed shaft being mounted on spherical bearings. On the front cardan shaft there will be flexible couplings of leather or rubber, and on the rear cardan shaft ball or roller bearing universal joints of special design.

The front axle will be H section stamping of high quality steel. Swivel axles are of 60 ton steel with floating bushes for road wheels. The tire size is 1,010 by 120 fitting British standard, 850 mm. rim diameter. Similar size twin tires are fitted for rear axle. In the YB type the rear axle is fitted with Lanchester worm and, in the YC with David Brown worm, having a gear ratio of 8¼ to 1. Roller bearings are fitted in the rear hubs, and the drive is through castellated high quality nickel chrome steel shafts. Foot and hand brakes of the usual type operate on independent drums on the rear wheels.

Steering will be by worm and nut type gear, with ample bearing surface everywhere, ensuring exceptionally long life, fitted with 18 in. ebonite covered wheel. Springs are all of chrome vanadium steel, with specially stiffened eyes, a volute spring being fitted over the rear axle. The frame is of high tensile steel, $\frac{3}{32}$ in. thick, fitted with high tensile cross members of great strength. A 30-gallon tank (fitted with needle valve) is placed under the driver's seat. Wheels are of steel castings of exceptionally strong design. Delivery of the vehicles will be taken at the Walthamstow works.

OVERSEAS MOTOR TRADE.

A Commissioner's Tour of the Markets.

The Association of British Motor and Allied Manufacturers have appointed Major R. E. Goddard as their overseas commissioner for the purpose of conducting a tour of investigation of the markets of Australasia, India, and the East. Major Goddard left this country at the end of February, and his tour will embrace Ceylon, the Dutch East Indies, Australia, New Zealand, Japan, China, Malaya, Burma, and India, in the order named. He will reach Ceylon about the middle of March, and the whole tour will occupy about a year. From this it will be possible to gauge roughly the dates of his arrival at other points, though it is not, under present circumstances, possible to state them accurately in advance.

Major Goddard has been appointed, after consideration of the claims of applicants numbering well over a hundred. He has made a special study of overseas commerce, with regard to which he has a wide and varied experience, especially in connection with the motor industry. Many of his conclusions have already been published in his book "General Cargo," a volume dealing with the organisation and political economy of the export trade and with the cultivation of foreign markets. He is, moreover, a trained engineer.

Although Australasia and the Far East form the objective of the immediate campaign, it is probable that operations will be extended to other territories in the event of the results of the first tour being as satisfactory as are anticipated. It is hoped that the results of the tour will be very considerable and that, through Major Goddard's reports, the British industry will be enabled to gauge with much greater accuracy the general or average requirements of foreign markets, both as regards type of vehicle and as regards the most acceptable methods of doing business.

The association is acting in conjunction with the Overseas Trade Department of the Government, which is assisting in every way, partly as regards finance and partly as regards official introductions and shipping arrangements.

MOTOR EMPLOYERS' FEDERATION.

The National Council of the Commercial Motor Users' Association has been informed that the Government will shortly require employers to join a suitable federation in order to regularise dealings with labour. The Council has accordingly entered into an arrangement with the Motor Transport Employers' Federation under which the new conditions can be met by haulage contractors and other owners of commercial motor wagons or vans. Mr. F. G. Bristow, who is secretary to the two bodies, can be addressed at 83, Pall Mall, London, S.W.1, for fuller information.

ROAD MOTOR TRACTION.

EVIDENCE BEFORE THE COMMITTEE ON TRANSPORT.

An abstract of the evidence given before the Committee on Transport shortly before the close of last session of Parliament was published in our issue of February 13, 1919. The following is a summary of interesting testimony laid before the Committee in reference to road motor transport and omnibuses:—

Sir William Marwood, joint permanent secretary of the Board of Trade, stated that the Board set up a Road Transport Board as a war measure entirely. Before the war the Board of Trade had nothing to do with road transport, except on a very small matter. The weight of motor vehicles and all that sort of thing is a matter for the Local Government Board, and the only control the Board of Trade had on road transport is that certain owners of bridges have power to limit the weights of vehicles passing over them, and in the case of railway bridges a complaint if made is adjudicated on by the Board of Trade; in the case of any other bridges it is not a matter for the Board of Trade. Certain Corporations have taken power to run motor omnibuses, and Parliament has put in a provision that the fares are to be approved by the Board of Trade. He did not know why they put in "The Board of Trade," but they did it, and when it is in you cannot get it out again. In one case at least—namely, Eastbourne—the Board of Trade have power to approve the route. Everybody wants a motor omnibus to run down the next street and not down his own street. A limited company wants no power to run motor omnibuses at all; they can run them as they like and anywhere they like. The police have some authority in London as to the routes.

As to setting up a motor omnibus undertaking, a limited company can do it without any statutory power at all, whereas a Corporation cannot, because it cannot spend capital except on certain authorised objects, so it has to go to Parliament.

Asked whether it is not the rule in provincial towns for the Corporation to have absolute authority as to preventing any omnibuses from being run, Sir William said there is only one way and that is they can refuse to license the vehicles. Under the Local Government Emergency Act, 1916, however, there is the power to stop new routes, but not to stop existing routes.

WORKMEN'S FARES.

In regard to workmen's fares on motor omnibuses, the difficulty is that if you fill up the omnibuses with passengers paying fares anything approaching the London County Council's workmen's fares you would be running your omnibuses not at an estimated loss, but at an actual loss. Without taking in the cost of administration, or anything of that sort, on your petrol bill you would be running at a loss. In normal times a motor omnibus would be losing at the County Council fares, or at any fares like they have on the Great Eastern of 2d. to East Ham, or 20 miles for 2d.—any fares like that would kill a motor omnibus service; but taking the case of a railway with a train full of workmen in normal times on normal costs of working, those trains are not run at a loss. Some railway companies would argue that they are, but his own opinion was that a full train does not run at a loss.

He doubted whether there was a heavy loss on tramcars running on workmen's fares. If you take a tramcar running fairly full in normal times, it holds a good deal more than a motor omnibus to begin with, and he doubted if there is a serious loss. As to whether the time has come when omnibuses should give workmen's fares, he said that the difficulty is that you cannot compel anybody to run a motor omnibus. On the other hand, most municipalties are under statutory obligation to run a reasonable service of workmen's cars on their tramways. There is no compulsion on a municipality to run a tramway, but if the municipality has an authorised tramway service, it is under obligation to run a reasonable service of cars, including a reasonable service during certain times of cars at workmen's fares.

GREAT WESTERN RAILWAY—ROAD MOTORS.

Mr. Frank Potter, general manager of the Great Western Railway, gave the Committee a detailed account of the road transport motor service provided by his company. He said they probably had done more than any other company in providing road motor services. The number of passenger cars in use is 110. They have been mainly for the purpose of dealing with such traffic as is ordinarily conveyed by passenger train, but, in addition to passengers, passenger train luggage and parcels, light goods and mails are conveyed in a number of cases. The railway parcels and parcels traffic local to the districts traversed are carried mainly on the roofs of the vehicle bodies, which are capable of conveying a weight of approximately ½ ton. The North Eastern Company have in recent years established a small number (about six) of similar services.

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Road motor services were commenced by the Great Western Railway in the year 1903. He handed in a statement showing the whole of the services instituted by his company, including those still in existence and those which had to be discontinued owing to difficulties created by the war. The passenger road motor services of the company now being worked are 33 in number, and 17 others have been discontinued.

The majority of these services connect small towns and villages with the nearest railway station, the distances from the railway of the places served ranging from 3½ to 21 miles.

The routes over which the services are run may be classified substantially as under :—

(1) Routes operated (*a*) to develop a district, though owing to the geographical difficulties of the country the probabilities of a railway being constructed for the same purpose are remote ; and (*b*) as a feeler to ascertain the possibilities of a light railway to feed isolated towns, the pleasure traffic incidental to such routes being a secondary rather than a primary factor.

(2) Routes operated primarily to serve places of holiday and tourist interest, which formerly were served either regularly or on an indefinite basis by private agencies.

In establishing services the governing idea was that facilities would be afforded to districts capable of development but remote from the railway or other reliable means of communication. Taking the Helston and the Lizard service as an illustration, its establishment has resulted in a large number of people visiting the district.

Many of the routes operated by the Great Western Company are virtually extensions of the railway, and in addition to such profits as may be earned it has to be remembered that there is a certain contributive value in the traffic brought to the railway which may be the factor justifying the introduction and continuance of such services.

He quoted statistics of passengers on various routes which showed that as between 1913 and 1918 there had in some cases been increases, but in others there had been decreases. He also gave particulars as to goods carried, showing that the receipts per mile were considerably above the working expenses. In regard to the possibility of developing agriculture by means of road motor goods services, he gave a case from Worcestershire in which the service was worked at a loss and was discontinued. The North Eastern Railway Company had a similar experience in connection with two services in the Northallerton and Brandsby districts. Both of these services were withdrawn since the outbreak of war.

It has to be borne in mind that when these services were instituted road vehicles were not as efficient as they are to-day, and it is conceivable that different results might follow the establishment of similar services to-day with modern vehicles in suitable districts, always provided that local agriculturists are prepared to co-operate with each other and with the railway companies.

The Great Western Railway Company have of late years introduced road motor vehicles for parcel cartage at the principal centres of their system. Three types are in use, namely, 3-ton, 1½, and 1-ton vehicles, the total number running up to 79. The cost per mile were respectively 6·32d., 4·46d., and 4·97d. In the second case the majority of the vehicles were new. As compared with horse vehicles the advantages of the motor parcel van were quicker delivery, extension of area, and ability to deal with abnormal traffic. Eighteen additional parcel vehicles are now on order.

Forty vehicles are engaged on goods collection and delivery, worked at certain large centres. They include steam tractors, petrol tractors, 5-ton lorries, 3-ton lorries, 1½-ton lorries, and, besides, four 5-ton electric lorries and eleven 3-ton steam lorries are on order. The following were some working costs per ton :—Steam tractors, 14·8d. ; 5-ton lorries, 23·93d. ; 3-ton lorries, 32·67d. ; 1½-ton lorries, 42·1d.

The improvement and development of the motor industry has been very fast, and just before the war he was getting much more useful types of vehicle than were available a year or two before.

In regard to the agricultural traffic, a good deal could be done if there was more co-operation between the farmers. The thing, however, that the railway company could not get over was that there was no response by co-operation on the part of the farmers to the provision of facilities. The attempt to get direct supplies from the country to the consumers has not worked out well.

ROAD MAINTENANCE.

The railway company do not have to make any arrangements with regard to contributing to the cost of the up-keep of roads in the district where they run their heavy motors. There is no legal right, he said, to exact any contribution. In connection with the development of their traffic on the Lizard Peninsula, the company were confronted with the allegation that their motor omnibuses were responsible for the increased wear and tear of the roads, and they were asked to pay for it. They replied that they were not prepared to pay for it, and that if the local authorities did not want the district developed, and did not want to respond to this enterprize, the company would take the cars away.

As part of the common user of a road the company should pay their proportion for the damage that they caused to the road, provided that everybody else who damaged the road paid his proportion. The company had taken up the position that their wear and tear of the road was not so much as that of many other vehicles. He agreed that if the tramway has to pay because it lays down its track, other people who use the road should also make a corresponding payment, but he also had to say that the tramway companies do not have to buy the freehold of the road, and if they keep the track up for their own purposes that is all they were required to do.

Mr. I. T. Williams, acting general manager and chief goods manager of the London and North Western Railway, gave the opinion that there is a tendency to develop road motor traffic in preference to canal traffic. That is particularly so in Lancashire, say, between Manchester and Liverpool, to the extent of even 100 motor vehicles, and by arrangement getting them loaded in both directions, which is often that which cannot be obtained in the case of canal traffic. In reference to the use of motor vehicles for railway purposes in London, there is no use of having the motor in the narrow streets of the city of London, where one can scarcely get a horse vehicle through. His company used motor vehicles for long-distance traffic in the north of England because they can get something out of them there.

ROAD TRANSPORT BOARD VIEW.

Sir Evan Jones, chairman of the Road Transport Board, said that that body was constituted purely to deal with special questions of transport during the war. He gave an account of its organisation and of the work which it had done, mentioning that its primary object was to obtain the utmost efficiency out of the existing means available so as to provide for the necessary road transport of food, fuel, and munitions, while at the same time obtaining adequate facilities for the needs of the essential trades and industry of the country. In regard to the possibility of the development of road transport after the war, he said that there is no doubt that the combines arranged by the Board are working to the advantage of traders and owners of transport concerned, and it is probable that if their control by the Board is withdrawn after the war the schemes will to some extent be continued on a voluntary basis. He mentioned especially in this connection the continuance on a voluntary basis of the Return Loads Bureaux, which were set up by the Board. It is necessary to guard against these bureaux developing into instruments of competition with canals, railways, or common carriers. The functions of the bureaux can be extended with a view to arranging exchanges and co-ordinating transport between individual firms and also for supplying emergency transport. He, however, could not conceive the possibility of the development of road transport of goods on independent through service so long as railway or water carriage is available. Neither can motor transport compete in restricted areas with horse transport. The future of commercial road transport is, he thought, restricted to its use as independent local service in areas of a fairly extended character and deficient in railway facilities for the internal traffic of the area itself, and as an auxiliary and feeder service to the railways and canals for extra area traffic. A system of light railways fed by horse transport would prove a powerful competitor.

Local conditions would largely determine the relative adaptability of light railways or of motor services for any particular area, but the need for better transport facilities in rural districts is urgent and immediate, and there are great opportunities for motor road transport to prove its utility in this direction. Before any considerable development could, however, take place, there is much to be done in the provision of a proper system of local roads, without which motor transport will be severely handicapped.

The policy inaugurated by the North Eastern, Great Eastern and other railway companies in running motor omnibus services in connection with trains should be still further developed. Special vehicles to carry both passengers and light farm produce, such as fruit, eggs, etc., could be designed. The existing Road Transport Area Offices could be retained and made the centre of road transport business in every town. All motor haulage contractors and horse carriers should be registered with the office, and questions of rates and other problems might be settled with each local officer.

DEVELOPING AREAS.

One of the first things to be considered in connection with reconstruction is the linking up of newly developed areas and areas still to be developed. Agriculture and home-grown timber propositions, including afforestation, coupled with the development of new areas,

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open up possibilities for the extended use of road transport after the war. Where good roads are in existence from railways and towns to newly developed areas, the development of such areas would at first largely depend upon the establishment of motor services to link them up with the railways.

The conditions which will obtain for some time after the war may render some form of Government assistance for road transport imperative.

The repair and making of new roads, and the building of houses will for some time create a great demand for road transport, and if houses are to be built away from towns with the idea of healthier surroundings; then, later, additional transport facilities, both goods and passenger, will be required to feed and maintain new districts until they are linked up by the railways.

With regard to the further development of road transport, other than by means of self-contained schemes in suitable areas which can be worked independently, apart from the continuation of useful schemes for united working arranged during the war, it seems obvious that road transport must be regarded as an integral and effective portion of the whole transport organisation of the country, and not as an isolated enterprise.

STANDARD VEHICLE WANTED.

The special sphere of road transport will be in local distribution and as a feeder accessory to trunk systems. To fulfil this object it must be cheap. The petrol-driven motor, as we know it to-day, is not economical either in first cost or in running cost. As a preliminary to any well-devised schemes for cheap road transport, there must be evolved a standardised type of motor vehicle, with its spare parts all standardised also, and with all nuts, bolts, and screws of standard threads and sizes.

If road transport is ever to become successful and to develop materially, it will never do so with the costly type of vehicle on the road to-day. You will never get any really good return until you have got some form of standardised vehicle which you can afford to run to death—that is practically what it means. It must be something which can be so very cheaply got that its maintenance is a secondary consideration.

The question of the eventual control and co-ordination of road transport depends on the measures decided upon for railway and other forms of transport. The development of road transport, as a main independent or trunk service, is unlikely to meet with any large measure of success. Any measure of control of road transport as an auxiliary and feeder service to the railways or canals must be regarded as a part of the whole, and be associated with the control of other forms of transport. As a separate service, the future development of road transport will be largely confined to self-contained areas where no other adequate transport facilities are available, and the retention of the Road Transport Board organisation in some modified form would be of considerable assistance in this connection in the co-ordination of services, and their adaptation to the general development of particular areas.

Sir Woodman Burbridge, managing director of Harrod's Stores, gave evidence as to his wide experience of the collection and delivery of goods in London. In regard to electrical vehicles, he said that he considered that electricity might be used in connection with this firm's road vehicles provided that the electricity could be obtained at a cheap rate. His firm use electric motors now very considerably. They have over 80, and for town deliveries nothing but electric motor vehicles. One advantage over the oil motor is that it is very much cheaper whenever there is much stopping and starting to do. His firm ran their electric motors at 1½d. per mile, where petrol motors at present cost them over 3d. The repairs of electric motors are very much less than those of petrol motors. The running cost of the electric motor now, as compared with the time before the war, was only about ¼d. per mile more for the extra cost of coal.

NATIONAL STOCK OF PETROL.

On February 24 the Government had in stock in Great Britain and Ireland 20,000,000 gallons of petrol, which the Petrol Control Department had imported. This quantity has since been available for sale. In addition the Government hold a large stock of aviation and motor transport fuel. Since the Government ceased to be the sole importers stocks have been accumulated by private importers.

GREAT DEMAND FOR CARS.—Although the dearness of materials has led to the price of many high-grade motor cars being increased by more than 60 per cent., manufacturers state that the demand for new cars is greater than they have ever known before.

L.C.C. AND MOTOR OMNIBUSES.

POWERS TO RUN AUXILIARY SERVICES TO BE SOUGHT.

The London County Council, on February 18, decided to apply for Parliamentary powers to run auxiliary omnibus services In reporting upon the proposals of the Highways Committee (particulars of which were given in our issue of February 13), the Finance Committee stated that if the estimates submitted to them by the Highways Committee were realised, the Council would not be involved in any financial loss upon the running of the omnibuses, without taking into account any increase of revenue which may accrue from induced traffic on the tramways.

ROAD TAX PROPOSAL WITHDRAWN.

The proposal that the Council should contribute on the basis of ⅜ths of a penny an omnibus mile to the road authorities, the Finance Committee remarked, raised a difficult question of principle. They understood that it might be modified in certain directions by the Highways Committee.

In the discussion on the proposed contribution to the road authorities, Mr. H. H. Gordon objected to the suggested charge of ⅜d. per omnibus mile on the ground that anything that made traffic dearer was prejudicial to the community. If the proposal was agreed to, there was no justification for not also taxing any vehicle using the road.

Dr. Scott Lidgett said that the scheme was sound, but there should be no tax on locomotion. If a tax was imposed it must be equitable and fall on all kinds of traffic in proportion to the injury to the highways.

When the debate was resumed on March 4, Mr. H. H. Gordon had given notice to move the reference back of the report having regard to the undesirability of imposing taxation on traffic. This, however, was not moved, as Mr. Hume withdrew the following recommendation:—

"To provide that from the revenues of the omnibus undertaking contribution be made at the rate of three-eighths of a penny per omnibus mile towards the cost of road maintenance, such contribution to accrue in moieties to the road authority and tramway authority in respect of mileage run in thoroughfares along which tramways are in operation."

Thereupon the recommendation to apply for statutory power was agreed to by the necessary statutory majority without a division.

AUSTIN AGRICULTURAL TRACTOR.—The Austin Motor Company, Limited, have produced a motor tractor for farm work which performs with ease tasks that would require four horses, such as a load of 4½ tons of grain. India-rubber grips are provided on the wheels for road traction, and on the land are replaced by spikes.

TRIPLEX SAFETY GLASS WIND SCREENS.—The new Enfield-Allday light cars are all fitted with Triplex safety glass wind screens before leaving the works. This protection for the safety of the driver and passengers, although adding slightly to the works cost, increases the value of the car, and it is interesting to note that the insurance companies have indicated their appreciation of this fact by lowering their premiums on road risks.

LORRIES FOR DISCHARGED SOLDIERS.—In reply to a question by Mr. Gwynne in the House of Commons, Mr. Kellaway stated that the Disposal Board of the Ministry of Munitions were prepared to supply War Department motor vehicles to discharged men who had been engaged in driving mechanical transport provided any approved organisation interested in their welfare was willing to undertake the responsibility of securing payment by instalments.

AUSTIN MOTOR COMPANY'S £4,000,000 ORDERS.—Addressing a general meeting of the Austin Motor Company, Sir Herbert Austin stated that as a result of the company's organisation for post-war business they had orders for nearly £4,000,000 worth of cars, lorries, tractors, and lighting sets. These came from the most important firms at home, in the Dominions, and in foreign countries. When in full work the factory would form the largest and most complete automobile plant in the Empire.

LOCAL GOVERNMENT BOARD AND MUD SPLASHING.—In reply to a suggestion by Bradford City Council that steps should be taken to deal with the nuisance caused by the splashing of mud by motor vehicles, the Local Government Board state that the question was considered by a Parliamentary Committee, which reported that experiments had not yet resulted in the discovery of a splashguard which would be likely to prove sufficiently suitable to justify its general adoption. The Board might have added that defective road surfaces are the chief cause of splashing.

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DEVICE FOR AUTOMATICALLY INCREASING THE LEVERAGE ON BRAKES FOR HEAVY MOTOR VEHICLES.

By Henry Mozley.

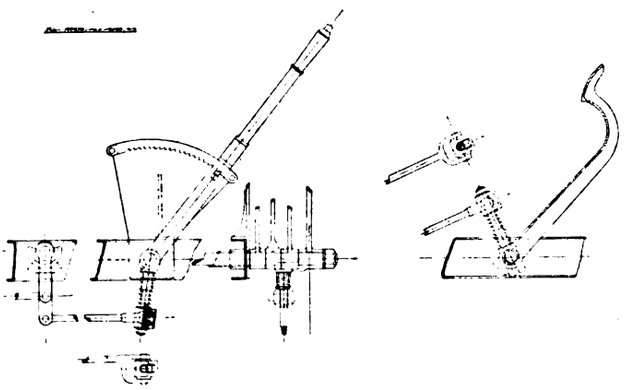
Heavy motor traffic, like tramway traffic, has had some sad experiences owing to brake failures, and whilst tramway brakes have had the attention of a committee of users, the employers of heavy motor vehicles have not published any data showing particular combined inquiry into the power of brakes or their improvement.

In view of the probable employment of motor omnibuses on heavy gradients in Burnley district, from personal observation of runaway heavy motors with fatal results, besides the frequency of similar accidents reported in the newspapers and technical journals of the motor industry, I came to the conclusion that the brake equipment was capable of improvement, and indeed must be improved to meet the requirements of a regular passenger service.

As an early member of the pioneer association (the Self-Propelled Traffic Association, Liverpool), I have never lost sight of the value of this form of transit and foresaw its present-day development, but I have had no opportunity as a user of going into the brake question till recently.

I now submit to your readers a practical invention which, I believe, will remove all danger from heavy motor traffic on steep gradients so far as brakes are concerned.

From a very long practical experience of tramway operation, I have had ample opportunity of coming to definite conclusions on



the question of brakes, and one of these is that the brake leverage (plus the pull by the driver) should exceed the gross weight of the car and maximum load. I think it will be found on investigation that this is not uniformly the case with heavy motors. To obtain an increase of leverage on existing brakes, with a minimum of alteration and expense, is the object of the device which is shown above, and I claim does accomplish this desirable and necessary object.

For the purpose of testing the device in service, I caused it to be applied to the hand brake on a Leyland motor overhead maintenance wagon, and its practicability and utility have been amply proved in months of service.

The device is designed to operate in either direction—modern practice requires the driver to pull the brake handle towards him, and this is the arrangement carried out on the Leyland chassis already referred to.

The following extract from the patent specifications will be sufficient to make clear how the device operates and its object:—"A brake mechanism having a lever with a projecting arm upon or in which slides a block or roller controlled by a spring or springs and connected to the brake, so as to keep the block or roller at the extremity of the arm or slot, and thus give the greatest travel at the commencement of the operation of the brake lever, preventing undue wear, taking up back lash developed by wear or want of adjustment. As the block or roller is pressed towards the fulcrum on the arm or slot by the operating lever, the power or leverage increases until it is at its greatest when the block or roller reaches the nearest point to the fulcrum, thereby giving a substantial increase in the brake power."

The whole operation is so simple that it is not necessary further to explain it, but I would advocate the use of the hand brake in regular service—always—and not occasionally and as supplementary to the pedal brake through the driving gears.

I believe the hand brake is gradually coming into use as the regular service brake, as I observed recently on the London General omnibuses. Whilst retaining the pedal brake as reserve, it will be found more advantageous, both as regards safety and economy of maintenance, to use the hand brake as the main brake.

I submit that a driver finding his hand brake ample in power, and easy to apply, will readily fall into the habit of using it for service. The device, as shown above, increases the leverage about 43 per cent., and seeing that this is accomplished without any alteration of brake mechanism, except the brake handle, users need not hesitate to apply the invention to existing vehicles.

LONDON OMNIBUS TRIALS.

Experiment in the Use of Duty-free Fuel.

Important announcements were made at a meeting of the National Benzole Association on February 26. Mr. D. M. Watson, chairman of this newly formed association of manufacturers, said that they had decided to be their own distributors, and with the goodwill of the motoring public he believed that they would pull through successfully. Benzole production was largely stimulated by the necessities of the war, the Government having given them a helping hand, with the result that they were in a strong position. At present the Government did not propose to impose an excise duty on benzole. The present output was 40 million gallons a year.

Mr. Shrapnel Smith, chairman of the Joint Committee for Mechanical Transport, claimed that the manufacture of benzole was a "key" industry, as was evidenced in those experiments in which benzole had been successfully mixed with both paraffin and alcohol. In this connection they would be interested to know that an experiment would be tried on a large scale on the streets of London within a few weeks, when 20 omnibuses would be run on that fuel.

Sir W. Keith Price said that it was now permissible for him to say that the whole of the Allies' explosive fuel programme had depended on the benzole and toluol produced in this country.

The National Benzole Association has fixed a standard of benzole for use as motor spirit. It will be water white in colour and free from acids, alkalis, and sulphuretted hydrogen, which causes a smell. The specific gravity is to be between ·870 and ·885.

MOTOR LEGISLATION COMMITTEE.

At a meeting of the recently formed Motor Legislation Committee, held at the Royal Automobile Club, under the presidency of Mr. Sidney Straker, Mr. Joynson-Hicks, M.P., stated that the Motor Legislation Committee at present consisted of the Automobile Association and the Society of Motor Manufacturers and Traders. They had decided that representation on the committee in future shall not be conditional upon subscription to its funds. In view of the important questions affecting road transport shortly to be brought before the House of Commons, he expressed the hope that all motor organisations would nominate representatives to serve on the Motor Legislation Committee.

The committee has opened offices at 83, Pall Mall, with Lieut.-Colonel Hacking, a solicitor, as general secretary, and Mr. A. Thomson as Parliamentary secretary. Mr. Joynson-Hicks is the chairman, and Mr. Rees Jeffreys deputy chairman. Among the objects of the committee are the following:—

Rapid removal of the war restrictions on the use of motor vehicles.

Restoration and strengthening of the roads and bridges.

Provision of a plentiful supply of motor fuel at reasonable rates.

The committee emphasise the fact that the recent railway strike demonstrated the extreme importance of road traffic, and that there is the possibility of large areas being dependent on its efficiency. Opposition is to be given to the Government scheme for placing roads under the control of the Minister of Ways and Communications.

In connection with the committee a Parliamentary Committee has been constituted of Members of Parliament, and at the time of the introduction of the Government Bill for setting up the Ministry nearly two hundred members had joined the committee.

In a statement issued on behalf of the Parliamentary Committee, it is remarked that they will seek to develop commercial transport in areas in which it is at present unprofitable.

Motor Coaches for Lancashire Tramways.—In their annual report the directors of the Lancashire United Tramways, Limited, state that they have decided to develop the motor transport business in conjunction with the tramways, and have placed orders for 25 motor coaches. It is hoped that the vehicles will be in service during the coming spring.

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MOTOR TRAFFIC

SOLID RUBBER TIRES MILEAGE GUARANTEE.

To the Editor, "The Tramway and Railway World."

SIR,—The practice of guaranteeing a minimum mileage for solid rubber band tires was developed in the infancy of the commercial vehicle. Its chief purpose was to show that in spite of the apparently costly nature of the tires they were, nevertheless, both practical and economical in application. It has achieved that purpose so effectively that nobody in these days has any doubt as to the resultant ton-mile economy of the solid rubber band tire, and that its efficiency tends to become more marked as experience of the conditions of use becomes more readily available.

Even under present unfavourable conditions large numbers of tires consisently give more than guaranteed mileage, and when the conditions are reasonably good, mileages running up to three or four times the guarantee are nothing out of the common.

The perpetuation of the mileage guarantee, however, is attended by certain marked disadvantages In the minds of users it leads them to expect the guaranteed mileage and nothing more. It tends towards the production of a "stereotyped" tire just capable of fulfilling the guarantee and no more. It encourages carelessness on the part of the driver, who regards the responsibility for the tire as solely that of the maker. It is necessarily hedged about by technical conditions and stipulations, which, in some circumstances, are difficult to see properly observed.

The members of the British Rubber Tire Manufacturers' Association have now decided to abolish the standard mileage guarantee completely, together with its limitations and stipulations. They will for the future be content to allow their products to be judged by the service given (as distinct from merely guaranteed), and are making it their business to see that their tires give the biggest mileage, the best service, and fullest satisfaction to their customers.

Considerable assistance in regard to these points is expected from systematic collective research, and the British Rubber and Tire Manufacturers' Research Association, which is now in process of formation, has an extensive programme of enquiry before it on the general subject of increased tire efficiency.

Of course it must be obvious that tire results will always vary according to the conditions of running, and especially the roads, but the members of the B.R.T.M.A. will constantly aim to produce the best tires.

Users can be assured of prompt and generous treatment to anyone who experiences unsatisfactory results, as although tires will now be supplied without mileage guarantee, they will not be supplied without full responsibility being accepted.

Yours faithfully,

W. B. PEAT AND COMPANY,
General Secretaries.

HALIFAX CORPORATION OMNIBUSES.

The accounts of the Halifax Corporation motor omnibus service for the year ended March 31, 1918, show a deficiency of £476 15s. 6d., which comes out at 2·381d. per mile run. The total revenue was £2,613 3s. 9d., or 13·05d. per mile, whilst the expenses were £3,089 19s. 3d., or 15·431d. per mile.

Subjoined are the details of the expenses per omnibus mile:—

TRAFFIC EXPENSES.	
Wages	4·383
Cleaning omnibuses	·401
Licences	·063
Uniform and sundries	·230
GENERAL EXPENSES.	
Third party and other insurances	·565
Deputations and sundries	·094
Proportion of rent, rates, and management expenses	·499
GENERAL REPAIRS AND MAINTENANCE EXPENSES.	
Bodies	·501
Chassis, Gearing, etc.	·583
Ignition fittings	·040
Engine and water circulation	·587
Oiling and lubricating	·683
Lighting fittings	·120
Garage and various	·538
Tires	1·089
Gas containers and repairs	1·136
Petrol	3·414
Gas	·505

MOTOR VEHICLES FOR MUNICIPALITIES.

MIDHURST RURAL COUNCIL propose to purchase a 5-ton steam tractor.

LEEDS TRAMWAYS COMMITTEE have sold a 5-ton steam wagon for £400.

SHEFFIELD CORPORATION have purchased three military motor lorries for £700.

WHITBY COUNCIL are considering the purchase of a motor to draw the fire engines.

WESTHOUGHTON COUNCIL have discussed the question of obtaining a motor ambulance.

LEYTON COUNCIL have applied for sanction to borrow £3,000 to meet the cost of three motor fire engines.

TODMORDEN COUNCIL have received a gift of a motor ambulance, and have appointed a committee to select it.

NELSON CORPORATION have decided to purchase a petrol motor wagon for use in the Highways Department.

BURY FIRE BRIGADE COMMITTEE have recommended the purchase of a motor fire engine at the estimated cost of £1,300.

SALFORD CORPORATION are to seek Parliamentary powers to run motor omnibuses in connection with their tramways.

HESTON AND ISLEWORTH URBAN COUNCIL have under consideration the purchase of a number of steam motor wagons.

WARWICKSHIRE COUNTY COUNCIL have decided to purchase ten steam motor wagons and trailers fitted with rubber tires.

LEEDS HEALTH COMMITTEE have decided to purchase another motor ambulance for hospital purposes as soon as possible.

POOLE COUNCIL have called for a report on the advisability of purchasing motor vehicles for the surveyor's department.

WARRINGTON COUNCIL have under consideration the purchase of a number of motor lorries for use in the highways department.

ROTHERHAM RURAL COUNCIL contemplate purchasing a motor ambulance for the removal of cases of infection to the hospital.

PONTEFRACT COUNCIL are considering the purchase of a motor fire engine and inquiring whether neighbouring authorities will share the cost.

PLYMOUTH CORPORATION Mental Hospital Visiting Committee have asked the medical superintendent to report as to the purchase of a steam motor lorry.

BURTON ELECTRICITY COMMITTEE have arranged to purchase an electric tipping wagon from Messrs. Ransomes, Sims and Jeffries, of Ipswich, for £1,262.

SCARBOROUGH CORPORATION are purchasing an electric battery machine for use as a water sprinkler and other street uses, and a petrol-driven wagon for general haulage.

SHEFFIELD HEALTH COMMITTEE recommend acceptance of the tender of Edison Accumulators, Limited, for the supply of three 2-ton electric tipping wagons at £1,304 each.

LEEDS CORPORATION have arranged for a workshop in connection with the fire brigade for motor vehicle repairs and asked the city engineer to secure the necessary machinery and fittings.

LIVERPOOL CORPORATION TRAMWAYS COMMITTEE have decided to instal the Bywater hydraulic system of petrol storage at their garage. The capacity of the installation is 20,000 gallons.

LONDON COUNTY COUNCIL have recieved recommendations from a number of Borough Councils to consider the provision of motor omnibuses for the purpose of linking up the tramway services.

SALE OF GOVERNMENT VEHICLES.

The Ministry of Munitions has announced that all the Government motor vehicles which are being dispensed with are sold by tender or by public auction after wide advertisement, and sales are being conducted in various auction rooms. Cars and lorries are also being sold separately. The only exception is in the case of obsolete machines or those of pre-war enemy origin. Motors are being disposed of in all parts of the country, and the needs of rural areas in connection with urgent food transport are constantly receiving consideration.

The Surplus Government Property Disposal Board is being continued under the Ministry of Munitions. The property for disposal is to be classified under seventeen different heads, each of which will represent a separate branch under a controller. Mechanical transport is to be under the charge of Lieut.-Colonel C. V. Holbrook. Surplus Government property can only be bought through this organisation, and inquiries should be addressed to the Secretary, Disposal Board, Armament Buildings, Whitehall Place, London, S.W.1.

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MOTOR TRAFFIC

WAR MOTOR WORK OF THE G.W.R.

During the war the staff of the motor depot of the Great Western Railway Company at Slough have undertaken special work for the Government. In one direction the work took the form of repairing A.S.C. motor lorries and engines to the order of the Ministry of Munitions. The existing shops at Slough being somewhat small for coping with the overhauling of the large fleet of mechanical road vehicles now owned by the company, an existing open shed was converted into a four-bay chassis erecting shop, with high doors of the roller-curtain type. The shop is lighted overhead by gas, with the lower lamps and flexible leads electric.

Various types of British and U.S.A.-made chassis and engines were thus overhauled during the war, including a number of 5-ton Berna vehicles. Ten of these Berna chassis were overhauled at Slough and then sent to Swindon to have G.W.R. chars-a-banc type bodies fitted, the vehicles being eventually used for the conveyance of munition workers in various parts of the country.

In addition to heavy chassis of such makes as Pagefield, Maudslay, Berna, and Kelly, a set of light Sunbeam chassis were put through the Slough shops in 1917, being then utilised by the Ministry of Munitions for conveying officials about London, they being handled, the *G.W.R. Magazine* believes, by lady drivers.

Owing to the recruiting from the motor car department being over 50 per cent. of the total pre-war staff, the Slough shops could not have coped with this additional war work and at the same time maintained the company's road motor vehicles, had it not been for the considerable assistance rendered in connection with the latter work by the department's out-station staff at the twenty-nine road motor depots. These depots have contributed largely to the overhauling of their own spare service cars, in addition to their regular work of doing running repairs only, and thus relieved the Slough shops to a sufficient extent to allow of the Government work being consistently carried on.

The company gave permission to Mr. G. V. O. Bulkeley to act as consulting engineer to a committee of the Fisheries Board, which has been dealing with the augmented engining of fishing vessels during the war. A large number of vessels were engined, and individual propellers designed for each, so as to obtain the best propulsive efficiency when towing trawls.

Last year a preliminary drawing and specification were prepared at Slough for the design of a special type of heavy marine paraffin engine, suitable for powering fishery vessels in two, three, and four cylinder sets for single and twin screw installations. This design has now been fully developed and built to by a prominent firm of engineers in the Midlands. The engine develops ten brake horse-power per cylinder at 450 revolutions, and follows in several respects the successful marine internal combustion engine practice of the Pacific Coast of North America, where all the salmon craft, up to several hundred tons displacement, have large oil engines.

NAPIER LORRIES IN FLANDERS.

The accompanying photograph of Napier lorries taken in Flanders gives a realistic impression of the condition of the country behind the fighting lines. As will be seen, a portion of the road had been entirely destroyed by shell fire, and a temporary by-pass has been made around the crater. The bleak aspect of the countryside is typical, and the character of the runs which the motor lorries had to make is vividly portrayed. The construction of the temporary road is illustrative of some of the minor difficulties with which the labour battalions under the supervision of the Royal Engineers had to cope. It is interesting to note that one Napier lorry which was in the retreat from Mons is still running, and has received official sanction to be christened "Charley's Aunt," the name which the driver has proudly painted on both sides of the bonnet.

ELECTRIC STARTERS FOR CARS.

It is no new or untried device which Messrs. C. A. Vandervell and Company are able to place before the public now that the approach of peace has enabled them to turn their energies from production for war purposes only. In the C.A.V. new electric starter motorists have a reliable instrument that operates with both ease and effectiveness. Its history goes back to 1917, and its triumphs have been scored on air machines as well as on every type of internal combustion engine running on the road. With so convenient an appliance, one can hardly imagine a car owner any longer taking the risk of a broken wrist, or permitting his servant to do so.

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MOTOR TRAFFIC

MOTOR TRAFFIC NOTES.

OMNIBUSES IN SYDNEY.—The traffic authority has lately been directed to issue licences for motor omnibuses wherever the conditions of the traffic permit. On various suburban routes over 20 single deck vehicles are running.

DAMAGES FOR MUD SPLASHING.—The sum of one guinea was awarded to a plaintiff at Wells County Court on February 18 for damage to her dress by mud splashed by a motor car. The allegation was that the car was driven negligently and furiously.

GLASGOW'S MOTOR EXAMINER.—The Corporation have appointed Mr. D. C. Maclachlan, of the Glasgow Automobile Company, as official examiner of motor cabs and drivers at a fee of £25 for each annual inspection of cabs and 2s. 6d. for each driver examined.

CAR'S SPEED WITH AEROPLANE ENGINE.—On February 17 a car fitted with a twin six-cylinder aeroplane engine, at Daytona, Florida, traversed five miles in 2 min. 34 sec., ten miles in 4 min. 9 sec., and 20 miles in 9 min. 21 sec. These times break three world's records.

GLASGOW MOTOR EXHIBITION.—Rennie Motors, Limited, have offered Glasgow Corporation a rent of £1,000 for the use of the exhibition building for two or three weeks in January, 1920, for the purpose of holding a motor exhibition. A committee of the Corporation recommends acceptance of the offer.

TRANSPORT COMMITTEE AT HUDDERSFIELD.—A Transport Committee has been appointed by Huddersfield Town Council, with Councillor Hoyle as chairman, and Councillor W. H. Sutcliffe as vice-chairman. A sub-committee has been appointed to ascertain exactly the transport requirements of each department of the Corporation.

TRANSPORT DISCUSSION AT NORWICH.—The eastern divisional officer of the Road Transport Board recently held an informal inquiry at Norwich in order to obtain the views of those interested in the question of rural transport facilities in the districts between Norwich and London. Suggestions were put forward for both light railways and road motor vehicles.

PRICE OF MUNICIPAL MOTOR FUEL.—The gas works of Leeds Corporation produce between two and three hundred gallons of benzol per day, and under the direction of the Benzol Manufacturers' Association the selling price is half a crown per gallon. The local branch of the Motor Cyclists' Fuel Union contend that a fair price would be one shilling per gallon, and they have asked the Corporation to sell at from one shilling to eighteenpence.

CROYDON RELIEF ROAD PROJECT.—For three years before the war it had been planned to construct a by-pass road from Thornton Heath to Purley, thus giving to motor traffic an alternative route on two miles of the Brighton-London road through Croydon. Before the war Croydon Corporation estimated the cost at £88,643, but it is now put at £148,237. They have decided to proceed with the scheme, and the Road Board have increased their grant from £15,000 to £55,000.

TRUCK EXPORTS FROM U.S.A.—During November last the United States exported only 974 motor trucks as compared with 1,496 in the corresponding month of 1917. To the United Kingdom 32 vehicles were shipped, while France took 422. For the 11 months ended November last 9,412 vehicles were shipped as against 13,672 for the similar period of 1917. Although the war import tax was then in existence, the United Kingdom received 2,254, and France 2,986, while Canada took 1,499 and Cuba 507.

MOTOR MAIL SERVICE.—The war has been responsible for not only deferring the institution of many new road motor schemes for the transport of the mails, but in some instances it led to the temporary withdrawal of existing facilities owing to the need for petrol economy. Before long the Post Office authorities are likely to institute many new services. Consideration will doubtless be given to the question whether the existing plan of putting the work out to contract will be adhered to, or whether the department shall own and run the vehicles.

MOTOR COACH TOURS RESUMED.—A popular feature of the two summers of 1913 and 1914 were the motor coach tours arranged by Chapman & Sons, of Eastbourne. These are to be resumed on May 26, the programme of the arrangements being now available. Tours will be undertaken to Aberystwyth and North Wales, North Devon, and the Cornish Coast, Lands End and the Cornish Riviera, Scotland (Oban) and the English and Scotch lakes. Each trip will now start from the Grand Hotel, Charing Cross. The fares are inclusive of hotel accommodation, and considering the present increased cost of living the advances over the pre-war charges are not unreasonable.

MOTOR TRANSPORT DEMOBILISATION.—Lieut.-Col. Spender Clay, in the House of Commons, asked the Secretary of State for War at what date he expected to complete the demobilisation of all non-commissioned officers and men who enlisted in the Motor Transport before January 1, 1916, and have employment awaiting them officially approved. Captain Guest replied that it was not possible to say definitely when the demobilisation referred to would be completed, but it was hoped that those eligible for demobilisation under existing regulations would have been released by May 1, except in so far as they might be temporarily required for the military machinery of demobilisation.

TRANSPORTING THE WOUNDED IN LONDON.—The vehicular section of the London Ambulance Column, a voluntary organisation, disbanded on February 15, thus bringing to a close the excellent work they have accomplished in transporting the sick and wounded to the various hospitals from the ambulance trains arriving in London. These cases numbered over half a million, besides which the section carried in their motor ambulances 75 per cent. of the casualties sustained in the air raids. Mr. B. R. W. Crothers, deputy director of the ambulance column, states that the majority of the nurses and drivers were on continuous voluntary day and night duty, every day of the year, some since the outbreak of the war.

MUNICIPAL OMNIBUS PROPOSALS.

COVENTRY.—The City Council are considering a scheme for motor omnibuses to feed the tramways service.

WHITCHURCH.—The Urban Council are in communication with neighbouring authorities with the idea of developing motor omnibus services for country districts.

PLYMOUTH.—The Traffic Sub-Committee of the Plymouth Corporation Tramways Committee are preparing a report on the question of the extension of tramways and the running of motor omnibuses.

WEST HARTLEPOOL.—The Corporation are considering the desirability of seeking Parliamentary powers for the running of motor omnibuses in West Hartlepool and beyond the borough boundaries.

STOKE-ON-TRENT.—At a meeting of Stoke-on-Trent Council the Estates Committee reported that they had taken steps for obtaining Parliamentary powers to run motor omnibuses. The present omnibus service is regarded as inadequate.

BUXTON.—A scheme is before the Buxton Council for obtaining powers to run motor omnibuses to provide communication with outlying districts. The services would also prove valuable for conveying to and from the railway station the large number of Manchester business men who reside in the locality.

WALSALL.—Having had a deputation from the Pelsall District Miners' Association asking for more motor omnibuses to enable the men to reach work with greater convenience, Walsall Tramways Committee suggest an expenditure of £10,500 for the purchase of additional motor omnibuses.

MOTOR OPENINGS IN CANADA.

The *Board of Trade Journal* announces that a manufacturer's agent at Winnipeg wishes to be placed in touch with United Kingdom manufacturers of motor cars, accessories, tires, etc., with a view to acting as agent on a commission basis with exclusive rights for the territory from the Great Lakes to the coast (Western Canada). He estimates that Manitoba, Saskatchewan, Alberta, and British Columbia will absorb over £22,000,000 worth of automobile equipment and tires during the present year. Further particulars may be obtained from the Department of Overseas Trade, 73, Basinghall Street, London, E.C., and quote the reference number 150.

The construction of 10,000 miles of good roads as early as possible is one of the reconstruction proposals of the Canadian Government, the Dominion Treasury advancing 40 per cent. of the cost.

STRAKER-SQUIRE, LIMITED, PURCHASE A NATIONAL FACTORY.—For the sum of £140,000, Straker-Squire, Limited, have purchased the National Aircraft Engine Factory at Edmonton. The transaction gives the country a profit of £7,000 on the cost price. It is proposed by this well-known firm of manufacturers of private and commercial motor vehicles and municipal utility machines to transfer the whole of their activities to Edmonton. In the construction of cars they propose to concentrate upon two models. One will be a six-cylinder private car and the other a four-cylinder commercial chassis suitable also for omnibuses. The factory will be organised on lines of quantity production, and will employ 5,000 workpeople.

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THE Tramway & Railway World
WITH MOTOR TRAFFIC SECTION

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WHITE BAY POWER STATION OF THE NEW SOUTH WALES RAILWAYS.

A PAPER READ BEFORE THE ELECTRICAL ASSOCIATION OF AUSTRALIA

By O. W. BRAIN, M.I.E.E. (*Chief Electrical Engineer*).

The New South Wales Railway Commissioners' Metropolitan electric power supply, while providing the traction current for the Sydney tramways, also furnishes electric power for the railway and tramway workshops, and the numerous auxiliary services of the department throughout the metropolis, including the signalling system, elevators, conveyors, lifts, pumps, air compressors, etc. The Commissioners' lighting load in the city and suburbs is considerable, and in addition there is quite a substantial output to other Government departments for the sewerage services, swing bridges, etc.

The area covered by the Sydney Electric Tramways is shown in Fig. 2, on which the tracks are drawn in continuous lines. As a matter of interest, the Melbourne cable tramways are shown by broken lines superposed. The scale is indicated by concentric circles, a mile apart, the Post Office being the centre.

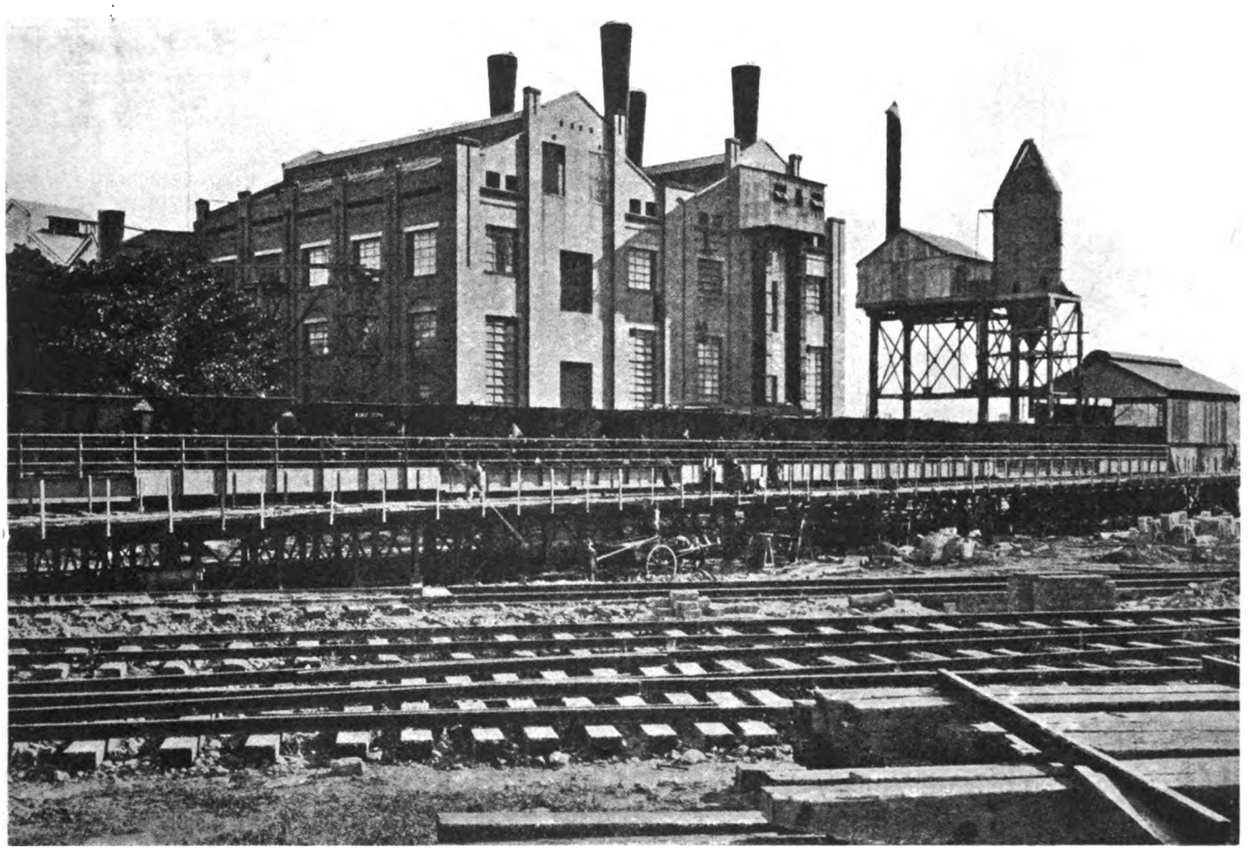

Fig. 1.—White Bay Power Station, Sydney, New South Wales, showing Elevated Railway Tracks and Pneumatic Ash Plant.

The continuous ratings of the seven turbo-alternators now installed in the Ultimo Power-house aggregate 36,000 KW., while the total evaporative capacity of the sixty water tube boilers is 580,000 lb. water per hour. The effort to utilise this site for an output much in excess of that for which it was originally selected,

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or for which it was suitable, presented many difficulties, indicating the wisdom of taking early steps to establish a modern power-house on a much larger scale.

Power Required.

The loading due to the tramways and other existing services of the Commissioners in the metropolis from the year 1906-7 onwards, is shown on the loading curve in Fig. 3, which was prepared in 1912, the forecast being continued in dotted lines from that year at the same rate of increase as the previous two years. The actual loading since 1912 is shown by full lines. After maintaining very closely the previous rate of increase for a further two years, the curve falls slightly in 1914-15, and has since continued practically level. This is, of course, an effect of the war.

In dealing with future requirements, however, it has been recognised that the existing loading will, in all probability, be rapidly dwarfed by the requirements of railway traction, which may be expected to reach something of the order of 100,000 kilowatts within a measurable period after commencing operation.

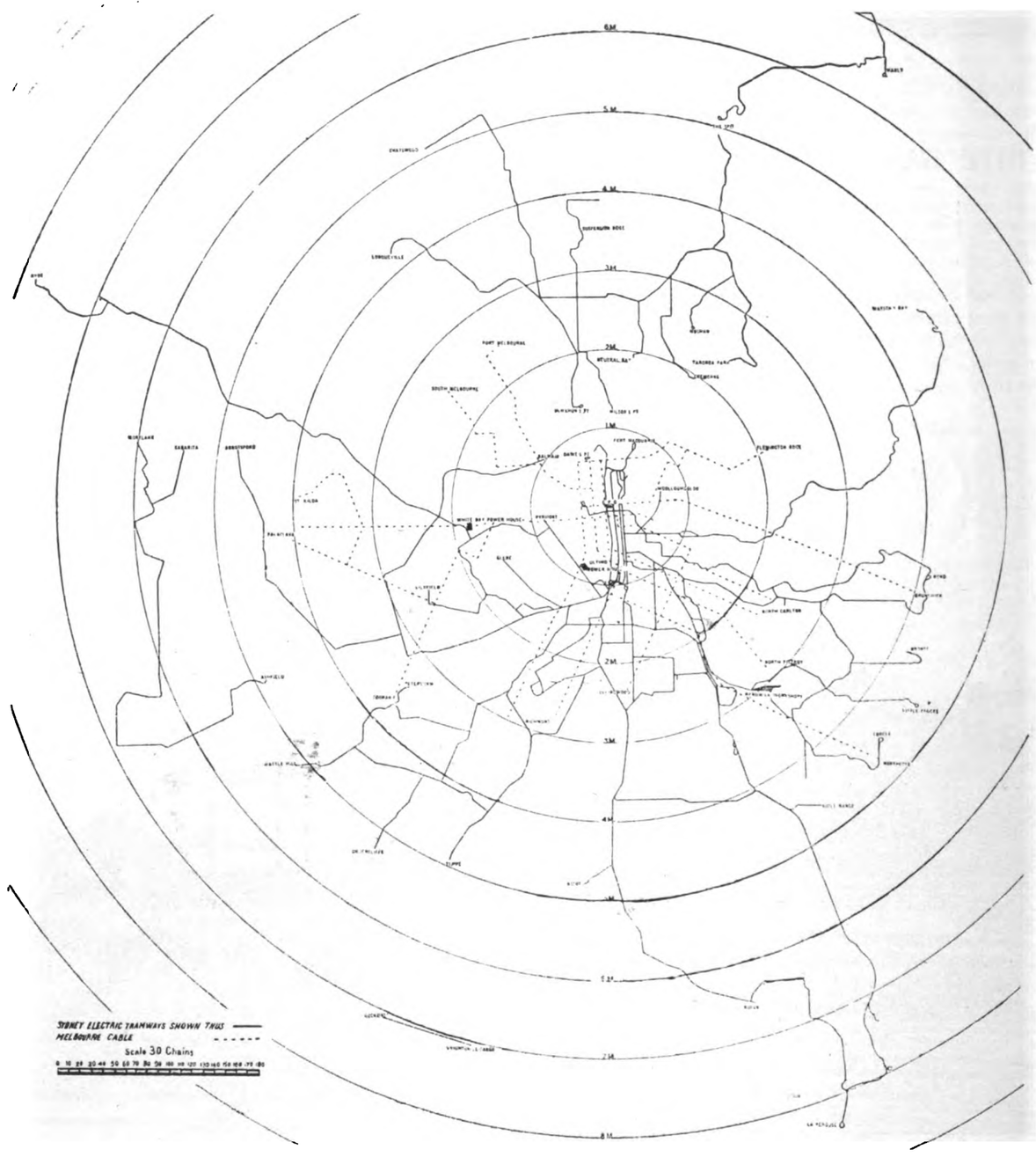

Fig. 2.—Area Covered by Sydney Electric Tramways, showing also, in Dotted Lines, Comparative Extent of Melbourne Cable Tramways System.
(Circles indicate mile distances from General Post Office.)

System.

In pursuance of my recommendation that early steps should be taken to establish an additional source of electric supply for the metropolis designed on a larger scale than the Ultimo Power-house, the question of the class of generating plant to be adopted was made a matter for special investigation during my visit to Europe and America in the year 1910. As it had not been shown that there was any water power in the State

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which it would be good public policy to transmit to Sydney for the purpose in view, there remained two preliminary problems—first, whether the location of the generating plant should be at the mine or in the area of supply ; and second, whether the prime movers should be gas engines or steam turbines. The former question resolves itself, of course, into a comparison of the cost of transportation of the coal with the total costs of transmission of the current over the distance in question ; allowance also being made for the local advantages for generation at each end.

Transmission.

Selecting the western district as presenting the best case for transmission, the distance may be taken as 90 miles. Adopting a pressure of 100,000 volts, with a maximum load of 100,000 kilowatts, and a load factor of about 40 per cent., representing an output of one million kilowatt-hours per day, and allowing a duplicate line with good steel tower construction, the cost of transmitting the energy, inclusive of capital charges, with copper at £70 per ton, would be not less than ·07d. per kilowatt-hour delivered. The transportation of the coal at the cost to the Commissioners, viz., ½d. per mile per ton, allowing a fuel consumption of 2 lb. per kilowatt-hour, represents ·04d., showing a margin of ·03d. per kilowatt-hour in favour of generating in the metropolis. While it has to be admitted that the first cost of the city site is greater than that of an equal area in the western district, this disadvantage is entirely outweighed by the unlimited circulating water supply available in Sydney ; in addition to which there are other financial advantages, connected with staff, repairs, and concentration of management, which do not call for elaboration here. An important consideration of a commercial nature was that in the placing of their annual contracts for coal, the Commissioners have frequently utilised the power-house orders to obtain improved terms in connection with the much larger railway requirements ; and the Sydney site allowed a special freedom of action in this respect. The net result was therefore very much in favour of the course taken. It will be recognised that the foregoing is not offered as a general comparison of the two methods ; and that the conditions specified apply, in their entirety, only to the Commissioners' service, and to the particular case under review.

Producer Gas Engines.

The relative merits of gas engines and steam turbines were being vigorously debated when the decision was required for the new station ; and in view of the very strong claims put forward for the former, on the ground of higher efficiency and the possibility of the return of a large part of the cost of the coal by the sale of the by-products recovered from the producers, the decision was one of considerable responsibility. One hesitated to commit the State to the installation of a steam plant representing an expenditure of approximately a million pounds sterling, and necessitating for an indefinite period of years a coal consumption of the order of a thousand tons daily, while confident statements were being put forward, and backed by a great display of apparently supporting evidence, that the same output could be obtained from gas plants, requiring only a fraction of the coal, and furnishing by-products which would pay nearly the whole cost of what fuel was consumed.

Most of our members followed with interest the gradual destruction of the gas engine's pretensions as a competitor of the steam turbine for this class of service. The failure of the attainable efficiency of the former to substantiate the claims advanced, and the steady improvements in turbine results, together materially reduced the discrepancy in fuel economy. Meanwhile the establishing of the limit of about 4,000 horse-power as the practicable size for the gas engine, put it at a disastrous disadvantage for large modern power-houses as compared with its competitor, which is now being built in units of 100,000 H.P., and has improved in efficiency with each increase in size. Then the troubles with engines using producer gas altogether falsified the hopes which had been encouraged by the successful operation of large furnace gas plants, where the refractory hydrogen content was not in evidence. And finally, the by-product recovery for the most part did not materialise as a practicable commercial undertaking.

It was with a lightened sense of responsibility therefore that I finally decided to recommend adhering to the use of steam turbines, a decision which has been consistently sustained by subsequent developments.

White Bay Power-house Site.

The selection of a suitable location for a large modern power-house absorbed much time, and involved the consideration of many sites, before that at White Bay was chosen as the one that most fully met all the salient requirements.

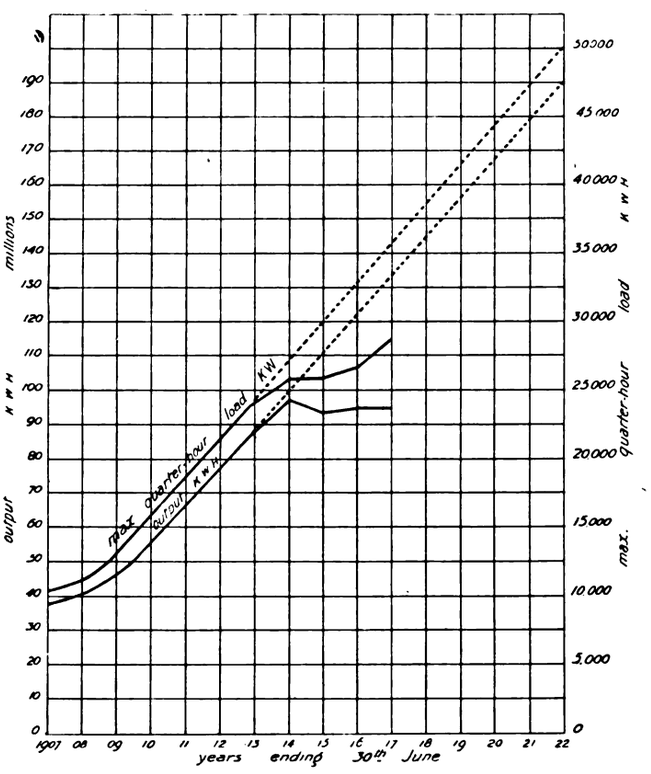

Fig. 3.—Diagram showing Load Forecast 1913–1922.

The available area is sufficient for a plant having an output of well over 100,000 kilowatts, and for the necessary tracks for satisfactorily handling the fuel, ashes, stores, and machinery, etc. The railway and tramway lines run practically through the site, thus providing at a nominal cost the necessary rail connection to these services. The conditions are also most favourable for shipping facilities, either for the delivery of heavy pieces of machinery from overseas, or, if necessary, for fuel. There is unlimited circulating water available from White Bay, and a sufficient depth to ensure practically the minimum temperature obtainable in the harbour. Glebe Island separates the inlet in White Bay from the outlet in Rozelle Bay, thus preventing the possibility of the temperature of the

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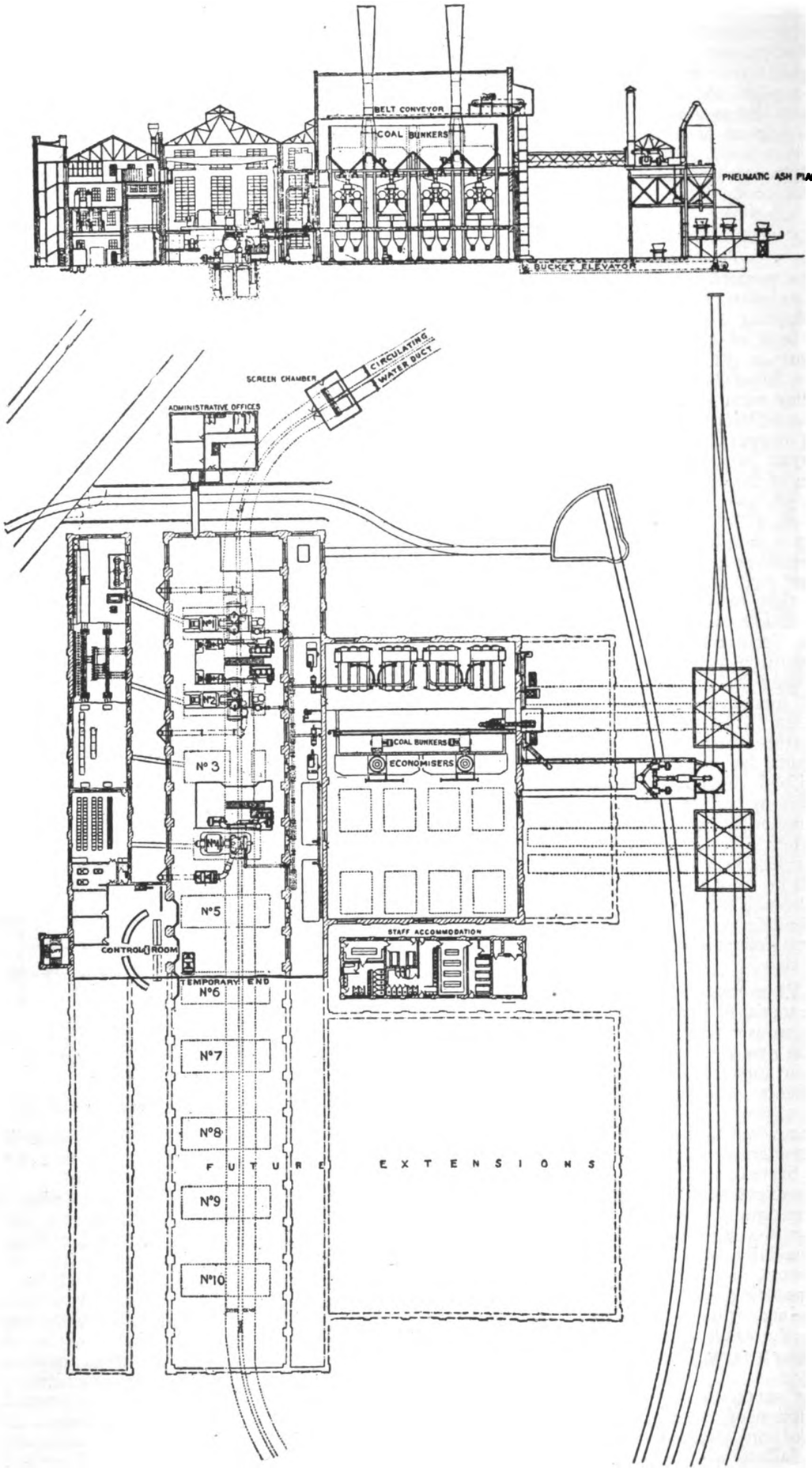

Fig. 4.—Plan and Section of White Bay Power-House, Sydney, N.S.W.

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supply being raised by the discharge—a contingency which it is necessary to provide when dealing with two million cubic feet of water an hour. The ground level over the whole area ultimately to be covered by the power-house was sufficiently low to permit of the minimum lift for the circulating water, without involving expensive excavating. The site is fairly centrally situated in relation to the existing electric system and to the future suburban railway service. This will be seen by a reference to Fig. 2, and in this connection it must be remembered that the Long Nose Point-Greenwich tunnel is being constructed to provide a direct route for the cables of the North Sydney services. And finally, in relation to all these advantages, the cost of the site was very low, partly as the result of extensive changes being made in the district by the department.

Unit Scheme.

The scheme provides for eight steam-raising units and ten electric generating units. Of the latter, one may be regarded as available for overhaul and one as standby, leaving eight complete power plants, each laid out in practically a straight line transversely across the power-house from coal hopper to outgoing feeders, and each equipped with the following:—A coal hopper under the railway track, coal elevator, and conveyor; a battery of boilers, each of which has an economiser and automatic coal weigher, motors for driving chain grate stokers and economiser cleaners, and a chimney stack and blower for each pair of boilers; a make-up water reservoir, a hot well and condenser recorder, and a motor-driven feed pump and feed water meter; a main turbine, alternator, and exciter, with ventilating fan and air filter; condenser, circulating pump, and air pump, and the generator reactances and auxiliary transformer; and generator, feeder, and transfer bus-bars and switches. Each such unit is connected throughout with the necessary water and steam piping and conductors, so that each is entirely separable, and can operate as a power plant independent of other units in all respects, except that under some circumstances it will be unavoidable that the steam headers of two or more units be connected, and there is a common current supply for the remote control of the switches. It is not considered that this claim is discounted by the fact that each coal bunker is common to two boiler batteries, and that the two circulating water channels under the turbine house provide for all units. The capstans for handling the coal trucks, and the overhead crane, of course, serve the whole power-house, and the pneumatic ash plant supplies the requirements of four boiler batteries; but other means of meeting this service are available for each boiler if required.

For each two units there is a spare motor, arranged so that it can be coupled up to take the place of the motor driving the stoker countershaft of either unit; and also a steam turbine-driven feed pump with Venturi meter to replace the motor-driven feed pump of either or both units. Stand-by alternate and direct current supplies, for the auxiliary services, are provided.

Buildings.

The plan and section of the station are shown in Fig. 4, the portion not yet erected being dotted in. The buildings, which comprise boiler-houses, pump-house, turbine-house, and switch-house, are of brick with galvanised iron roofing, the whole of the internal structural work being of steel, and the floors of reinforced concrete. The turbine house will have an internal length of 465 ft. 6 in., with a clear width of 60 ft. The height of the building, from the basement floor to the spring of the roof, is 67 ft. 6 in.; the turbine floor is 19 ft. above that of the basement; and the overhead crane clears the turbine floor by 38 ft. The turbine-house will accommodate ten turbo-alternators and their auxiliaries. The emergency motor-generator exciting sets are also placed in this house. At the northern end of the house the turbine floor is discontinued so as to form a dock, measuring 33 ft. by 19 ft. The machinery, stores, etc., are loaded into, or unloaded from, the railway or tramway trucks, or road vehicles, standing in the dock, by the 50-ton power-house crane. The tracks, which are laid on the basement floor, lead through the pump-house, past the tramway points, to a turntable, which provides a connection with the railways.

The object of the pump-house is to provide a safeguard in case of trouble with the piping systems; and also to house the steam valves, the feed water equipment, and the numerous measuring instruments under the most favourable conditions. It forms an annexe 18 ft. wide on the eastern side of the turbine-house, along the whole length of the building, and contains the main steam headers and valves, the interconnecting steam pipes between the units, the make-up water reservoirs, hot wells, condensate recorders, feed pumps, feed water meters, and recording steam pressure gauges. The workshop and stores are also accommodated in this section.

The arranging of the boilers in batteries at right angles to the pump-house presents three advantages over the parallel layout, viz., the unit system can be applied to all the boiler-house services, better lighting and ventilation are attainable, and the quota of boilers can be located adjacent to each turbine without having waste space in the turbine-house. The two boiler-houses will each accommodate four batteries of boilers.

The internal width of each house is 155 ft. 3 in., the height from the basement floor to the spring of the roof being 80 ft. The length of the future house will be 171 ft. 5 in., that of the present house being 106 ft. 5 in. The latter accommodates two batteries of four boilers each; but as developments during the construction of the power-house showed the feasibility and advisability of increasing the capacity of the plant, arrangements were made for increased boiler capacity in the second house, and the coal and ash equipment of the existing boiler-house were placed so as to admit of a similar extension ultimately.

The switch-house extends the whole length of the power-house, from which it is separated by an intervening space of 17 ft. The switch-house will measure 465 ft. 6 in. long by 30 ft. 3 in. wide, and has a basement accommodating the alternator reactances, the transformers for the auxiliaries, and the terminal equipment of the underground cables, a bus floor, a switch floor, and a shorter top floor, on which are the remote control boards and the secondary batteries and boosters, etc.

Circulating Water.

In connection with the circulating water provision, the experience gained at Ultimo has been very helpful in the effort to make the White Bay arrangements as near ideal as possible. The provision made will suffice for 12 million gallons of circulating water per hour. A concrete channel of ample dimensions, and 363 ft. in length, connects White Bay with the first settling well. The latter is furnished with fixed screens and two sluice gates, controlling admission to the two six-foot square ducts, which provide a total cross sectional area of 72 square feet.

The top of the ducts is 24 in. below the lowest known tide level; the ducts being therefore always charged with water under some head. At a distance of 500 ft. from the settling well is the strainer, which consists of

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two motor-operated rotary wire screens placed across the ducts so as to catch and lift all objects too large to pass through the condenser tubes. The screens, composed of brass wire, No. 12 S.W.G., with five-eighths inch square mesh, travel at 15 ft. per minute. The rubbish is removed by a revolving brush. From the strainer the ducts continue a distance of 90 ft. to the northern end of the turbine house, connecting with the two longitudinal channels, each measuring 17 ft. 7 in. deep by 7 ft. wide, which traverse the whole length of the building, being located immediately under the main condensers.

The western channel is used for the supply and the eastern for the discharge, vertical chambers being provided at each condenser in the outer sides of the channels to allow of the ends of the suction and discharge pipes being well submerged, while leaving the full section of the channel clear for the unimpeded flow of the water.

A motor-operated sluice gate is provided at the entrance to each channel, and a third between the two ducts. Similar provision is made at the southern end of the building where the channels connect with the ducts leading to Rozelle Bay, which have the same section as the northern ducts. At a distance of 300 ft. from the power-house there is a settling well of 20 ft. diameter, after which the ducts are continued a further distance of 363 ft. to the discharge well built in Rozelle Bay. This is a rectangular concrete structure 26 ft. square. It is divided into two chambers, each having a sluice gate at the end of the duct, and an open outlet into the bay.

The ordinary practice is to close the sluice gates in the power-house at the southern end of the western channel and at the northern end of the eastern channel, keeping all others open; thus drawing water from White Bay through both northern ducts, and discharging into Rozelle Bay through both southern ducts. The flow in the ducts may be reversed, however, by reversing the positions of the four channel sluice gates. It is thought that by occasionally adopting this course, and operating for a few hours with a low vacuum so as to raise the temperature of the discharged water, the vegetable and animal growths in the ducts ordinarily used for intake may be checked.

Coal Supply.

In the design of the coal supply arrangements consideration has been given not only to the three cardinal features already emphasised, but also to celerity of handling and facility of mixing; and if the provision made appears somewhat generous at first sight, it may be well to remember that each of the eight equipments has to be equal to providing fuel for an output of over 20,000 horse-power. Celerity of handling, it may be remarked, is necessary not only to fill depleted bunkers rapidly, but also to release the railway trucks, which have an apparently incurable habit of coming forward in overwhelming numbers after a lull.

A connection from the Glebe Island railway leads to the coal tracks, the duplication of which, while presenting the advantage of additional full truck storage accommodation, provides also for coal mixing. This is of no small importance, as the class of coal is quite frequently not a matter of choice; and there are some coals which do not burn at all satisfactorily alone, but with which fairly efficient combustion can be attained in a suitable mixture.

The coal tracks are erected on a steel viaduct at a height of 14 ft. above the ground (Fig. 1), to allow for the hopper over the conveyor filler, the floor of the chamber for which is eight feet below ground level. The hopper for each conveyor extends laterally under the two tracks sufficiently to allow of discharging the coal from both sides of a D truck on either track. By confining each type of coal to one track, the proportions for mixing correctly are under control. The trucks are brought up by motor-operated capstans as far as the northerly hopper, after which the empties gravitate down the grade over the automatic points to the kickback, and return on to the empties track, the grade of which allows of their being made up into trains. Each coal hopper is opposite its corresponding boiler battery. The top measures 21 ft. by 30 ft., and is furnished with a grid of three-inch mesh to stop large blocks of coal or foreign materials. The sides of the hopper are inclined at 40 deg. and 51½ deg. respectively from the horizontal. The coal is delivered direct from the bottom of the hopper into the rotary filler of the conveyor, which is of the gravity bucket type, travelling at 50 ft. per minute, and having a capacity of 50 tons per hour.

Boiler House.

The concrete conveyor tunnel extends from the bottom of the hopper to the foot of a steel uptake on the face of the boiler-house, at the top of which the coal is delivered on to the 18 in. troughed rubber belt, which travels at a speed of 300 ft. per minute to the end of the coal bunker over the boilers. The tripping device on the belt discharges the coal on either side as required, thus trimming the bunker; and it can be set to travel automatically to and fro from end to end of the bunker, thus ensuring as nearly as possible perfect mixture of the coal when desired. As each bunker serves two batteries of boilers, it is furnished with two conveyors, located with centres 25 ft. apart to ensure the best trimming.

The capacity of the existing bunker is 1,780 tons. It is 92 ft. long, 48 ft. wide, and 25 ft. deep, the sides having an incline of 45 deg. from the horizontal. The bunker is of steel framing, filled in with ferro-concrete. There are four openings for each of the two batteries of boilers, the bottom of the bunker being ridged between the openings to prevent trouble due to stagnant coal. Each opening feeds a Dennison automatic weigher, from which the coal passes into the distributing chute leading to the hoppers of the two chain grates of one boiler.

The boilers, which carry a pressure of 180 lb. per square inch, present the usual features of the Babcock and Wilcox make, having three steam drums 24 ft. 9 in. long by 4 ft. diameter, and 27 sections of 14 tubes each, 18 ft. in length and 4 in. in diameter. There are 148 superheater tubes of 1½ in. diameter, with a heating surface of 2,035 square feet; the total heating surface of the boiler being 8,283 square feet. The boilers are frequently worked to over 40,000 lb. of steam per hour each, with a superheat of 200 deg. Fahrenheit. The outer surface of the brickwork is treated with a coat of special paint, and steel casing is provided to reduce air leakage, the intervening space being packed with two inches of magnesia heat-insulating compound.

The grates, which have a combined area of 196 square feet per boiler, are a departure from the standard design, having an inclination of 1 in 6 from the horizontal to provide a suitable furnace for burning coal with a low volatile hydro-carbon content. Time does not admit of our following the troublous history of the development at White Bay of the most suitable furnace design for the southern coal. The problem was to maintain a sufficiently high temperature throughout the journey of the carbon to the end of the chain grate to ensure combustion, and also to provide favourable condi-

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tions for a thorough mixture of the gases in the furnace, while avoiding excessively high local temperatures and erosive action of the liberated gases, with consequent destruction of the firebricks. The department's last modification, during a service of over three years, has proved to be the only design combining highly efficient combustion with reasonable life for the brickwork.

The gases pass through the insulated uptake at the back of the boilers to the economiser on the economiser floor, as shown in Fig. 4. The economisers are of the standard Green type, each having 288 tubes, with a heating surface of 2,880 square feet, and the usual motor-driven cleaning device. The gases pass direct from the economiser into the chimney stack, which is of the inverted cone design, and is furnished with the Pratt cold air ejector system of draught. The advantages claimed for this arrangement are high efficiency, cool working blower, and ventilation for the boiler-house. The fan, which is coupled to an induction motor, operating at 485 revolutions per minute, furnishes a draught of two inches at the chimney base.

Ash Removal.

Owing to the turbine floor level being preserved in the boiler-room, the boiler-house basement is lofty and well ventilated. Nevertheless, it was considered advantageous to adhere to the system of ash removal which the department adopted to overcome difficulties arising from quite opposite conditions at the Ultimo Power-house.

The general features of the scheme are as follows :— Immediately under the back of each grate is a capacious hopper, extending into the boiler-house basement, and equipped with an ash valve at a sufficient height to allow room for a clinker breaker, which is propelled by hand on light rails laid in the basement floor under the ash valves. This track may also be used for skips to remove the ash in case of stoppage of the pneumatic service. The breaker is motor-driven, a wall plug and flexible lead furnishing the connection. An opening in the floor, ordinarily sealed by a flush cast-iron cover, is located under each hopper, so as to receive the discharge from the breaker. The covers of the openings constitute short sections of the upper half of the ten-inch suction pipe, of which there is a branch for each boiler battery. The extreme end of the branch in service is left open, as it is an essential feature of this system that a good stream of air must be passing continuously during operation. The unimpeded flow of the air is about 5,000 cubic feet per minute, the speed of travel being about 10,000 feet per minute. The thickness of the wall of the pipe is varied to allow for wear, being as much as two inches in the vicinity of the bends.

The department has established the fact that, with normal prices of £15 per ton for cast-iron, and £27 for hematite iron, the maintenance cost of pipes of the latter is considerably less than half that of cast-iron pipes ; a fact which does not yet appear to be appreciated by makers of these plants. The bends supplied by the contractors have massive renewable wearing plugs, which can be brought forward as wear occurs. They can also be removed to facilitate clearing of the pipes in the event of their choking. Filling is permissible at only one opening at a time, and therefore all the piping is of the same size. There are five bends in the path from the ash hopper to the 40-ton ash tank, which is mounted above the coal track, so as to discharge into one of the recently emptied coal trucks. The upper portion of the tank has an equipment of water nozzles, which maintain a fine spray, through which all the air has to pass. Having been relieved of all but the lightest dust, the air is conveyed through a Sturtevant air washer before entering one of the duplicate blowers, from which it is discharged through a 47 ft. steel shaft, of 48 in. diameter, into the atmosphere. The washer is of the makers' standard type, with fine nozzle sprays and eliminators. The blowers are of the Sturtevant make, with a three-arm impeller and idler. Each blower is direct coupled to a 70 H.P. induction motor, operating at 287 revolutions per minute, giving a pressure of 54 inches of water, with the full output of 5,000 cubic feet of air per minute. A useful feature of the equipment is the application of the system to the removal of the soot from the economisers.

Steam Piping.

The general steam piping scheme is shown in Fig. 4, and may be briefly described as consisting of the provision of ten short 33 in. diameter steam headers, on the basement floor of the pump-house, each having a connection to the corresponding turbine ; the four batteries of boilers in each half of the power-house are connected to the two outer pairs of the five headers, each boiler to the nearest header, headers Nos. 3 and 8 having no direct boiler connection ; and, finally, adjacent headers are connected. Each of the connections mentioned has a Hopkinson stop valve, the valves in the boiler main being operable from either floor of the pump-house. The headers are equipped with steam traps, and constitute efficient separators, and all valves are so placed as to avoid water pockets. The station design allows practically unlimited provision for expansion of the steam piping, due to temperature variations, and this feature has been freely utilised.

Pump House.

Each unit has a cast-iron make-up water reservoir of 17,500 gallons capacity, erected on steel joists, between the walls of the pump-house, at a height of 32 ft. 9 in. above the generator floor, and a 6,000 gallon hot well standing on that floor. The feed pump is of the centrifugal 6-stage type, direct coupled to a 440-volt induction motor, operating at 1,450 revolutions per minute, and has an output of 360 gallons per minute, at 204 lbs. pressure. The standby feed pump, which serves for two batteries, is of the centrifugal 2-stage type, direct driven by a single-stage Allen turbine, and furnishing, at 3,120 revolutions per minute, a supply of 480 gallons. This set, being intended for standby service only, was arranged to operate non-condensing. Recently, however, the exhaust has been discharged into an ejector condenser, using the feed water for the jet. This arrangement promises so well in regard to vacuum maintained, and resulting thermal efficiency, that it may be adopted for regular working; in which case a second turbo-pump would be installed, and the electric pumps retained as standby.

Turbine House.

The three turbo-alternators installed (Fig. 6) furnish 25-cycle, 3-phase current, at 6,600 volts. Two are of the Willans-Dick-Kerr make, with turbines of the disc and drum type, having a continuous rating of 7,000 KW., and an overload capacity of 10,500 KW. for two hours, the speed being 750 revolutions per minute. Each condenser is furnished with 3,830 tubes, providing a cooling surface of 14,050 square feet, in addition to which there is an augmentor condenser of 386 square feet. The Edwards three-throw air pump, with lift pump attached, operates at 105 revolutions per minute. The centrifugal circulating water pump is of Allen's Conqueror type, the casing and impeller being of gun-metal. It stands on the basement floor, 3 ft. 3 in. above highest known tide, and is located alongside

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the condenser, immediately over the chamber in the supply channel; the total length of circulating water piping from channel to pump, pump to condenser, and condenser to discharge channel being 56 feet. The submerging of the end of the discharge pipe ensures the syphon effect. The Dick Kerr alternators are furnished with motor-driven fans, and ample space is available in the basement for an air filter, which, in view of its success at Ultimo, will probably be of the cylindrical air-washing type. Three of the Willans-Dick-Kerr machines were ordered, but owing to British industrial troubles delaying delivery, a Curtis General Electric turbo-alternator was ordered and installed on No. 4 foundation, and No. 3 machine, on arrival, was installed at Ultimo. The American set operates at 1,500 revolutions per minute, and has a conservative continuous rating of 7,500 kilowatts, with no guaranteed overload. The exciters are direct coupled to the alternators in each case. The circulating water and air pumps and motors of No. 4 are similar in type to those for the Willans set, the pumps being coupled to 125 horse-power induction motors, supplied from the 440 volt transformer of the unit.

A duplicate set of 120 kilowatt, 440 volt, A.C., 120 volt D.C. reversible motor generators provides for the charging of the emergency battery, an emergency excitation service being available either from the battery or from the motor-generator. By reversing the motor generator, operating it with the battery current, the necessary 440 volt alternate current is furnished for the auxiliaries when starting up after a shut down.

It is of interest to note that the Dick Kerr alternator stators had to be built in separate halves to bring the weights within the capacity of the shipping appliances. The General Electric Company preferred to assemble the laminations of their stator *in situ*.

Switch-house: Considerations.

In the matter of the location of the switch apparatus, primary consideration was given to the importance of securing for the generating and switching equipments of a plant of this ultimate magnitude, that very necessary protection against the possibility of mutual interference which is obtainable only by housing them in separate buildings. While a parallel relation to the turbine house was approved as offering obvious advantages in preserving the unit design, sufficient intervening space was allowed to provide lighting and ventilation for both buildings. After due weight had been allowed for the considerations in favour of a remote control room some distance from the main building, it was decided that the greater advantage lay in preserving the operator's close association with, and constant knowledge of, the conditions in the turbine house, while locating him in a position safe from the effects of accidents to the running plant. The control room itself was therefore arranged to extend across a bridge spanning the distance between the switch and turbine houses, and is provided with windows opening into the latter just below the running rail of the crane. The operator is thus given a commanding view of the whole of the turbine house, from what will be a central position in the completed building.

An endeavour has been made in the design of the switch-house layout, to instal reliable apparatus with an entire absence of combustible material; to allow ample space everywhere, and as far as possible to arrange so that all portions of the equipment shall at all times be open to inspection. While it is hoped that these features will tend to prevent breakdown, it has been recognised that the unforeseen can and will occur occasionally, in spite of such precautions; and also that when high tension current, backed by thousands of kilowatts of running plant, gets out of hand, there is a degree of uncertainty about its behaviour. For instance, only a few weeks ago, when a piece of apparatus broke down at White Bay, the arc bridged the intervening space and fused portions of the equipment nine feet distant. It has been accepted therefore that considerable expenditure is justified to minimise the amount of equipment necessarily out of service while a fault exists at any one spot, a result which can only be achieved by a high degree of sub-division of the electrical equipment, with alternative connections of each separable part to the main system.

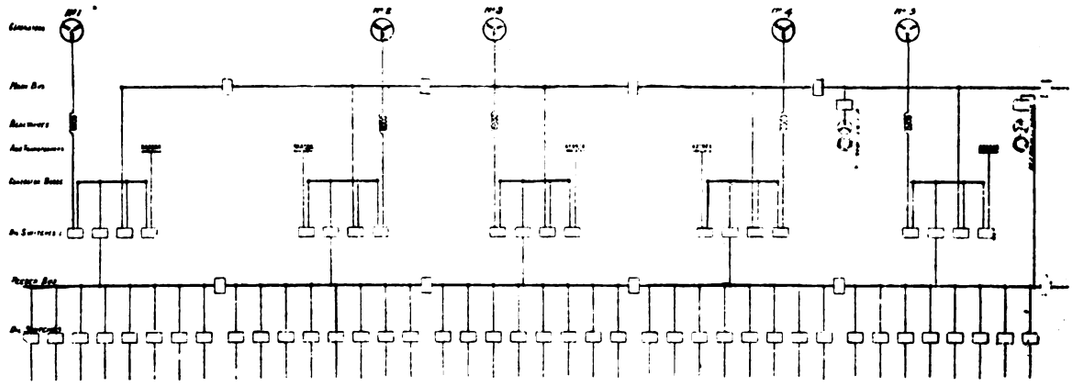

Fig. 5.—Diagram of Switchboard Connections—White Bay Power Station.

Switching Scheme.

The scheme finally adopted, as shown in Fig. 5, provides for feeder and transfer buses in sections, one for each unit, and separate generator buses. Each of the latter is furnished with its generator switch, the corresponding auxiliaries transformer switch, and group and selector switches. Oil switches separate the sections of feeder bus, but the transfer bus sections are united at present by knife switches. (Provision has, however, been made for oil switches later, if found desirable.) Each section of feeder bus supplies eight feeder switches. It will be seen that a generator can be laid up only by trouble in itself, or within the switches connected to its own bus. The arrangement also admits of each of any number of generators furnishing supply to its own group alone, while the remainder of the station operates in parallel. As each sub-station is connected to two or more feeder buses, no one fault in the switch-house can put a sub-station out of commission.

Reactances.

The question of the limitation of the possible magnitude of short-circuits is now recognised as one of

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primary importance in the design of large steam stations. Steinmetz has approximated the temporary output of energy from a station of the size of White Bay, in case of unprotected short-circuit, at from five million to eight million horse-power. The provision of some additional reactance is therefore imperative. After consideration of the various methods, it was decided to insert in each phase of each generator an external reactance coil designed to reduce the initial short-circuit to about twelve times full load. Each set of reactance coils is located in the basement on the turbine house side of the switch-house, alongside the corresponding 350 KW. auxiliaries transformer, from which it is separated by a brick wall.

It was considered undesirable to use a three-core cable between the alternator and the reactances, in view of the absence of any protection in case of short-circuit between the cores. On the other hand, there were objections to single-core lead-covered cables, on account of the inductive effects. Single core, varnished, cambric insulated, asbestos-covered cables were therefore installed in separate bitumenised fibre ducts, set in concrete. Some difficulty was encountered with these ducts, partly owing to the water-logging of the ground after rain; and therefore in view of the importance of this service, appearance was sacrificed to security, and the ducts were relaid above ground level.

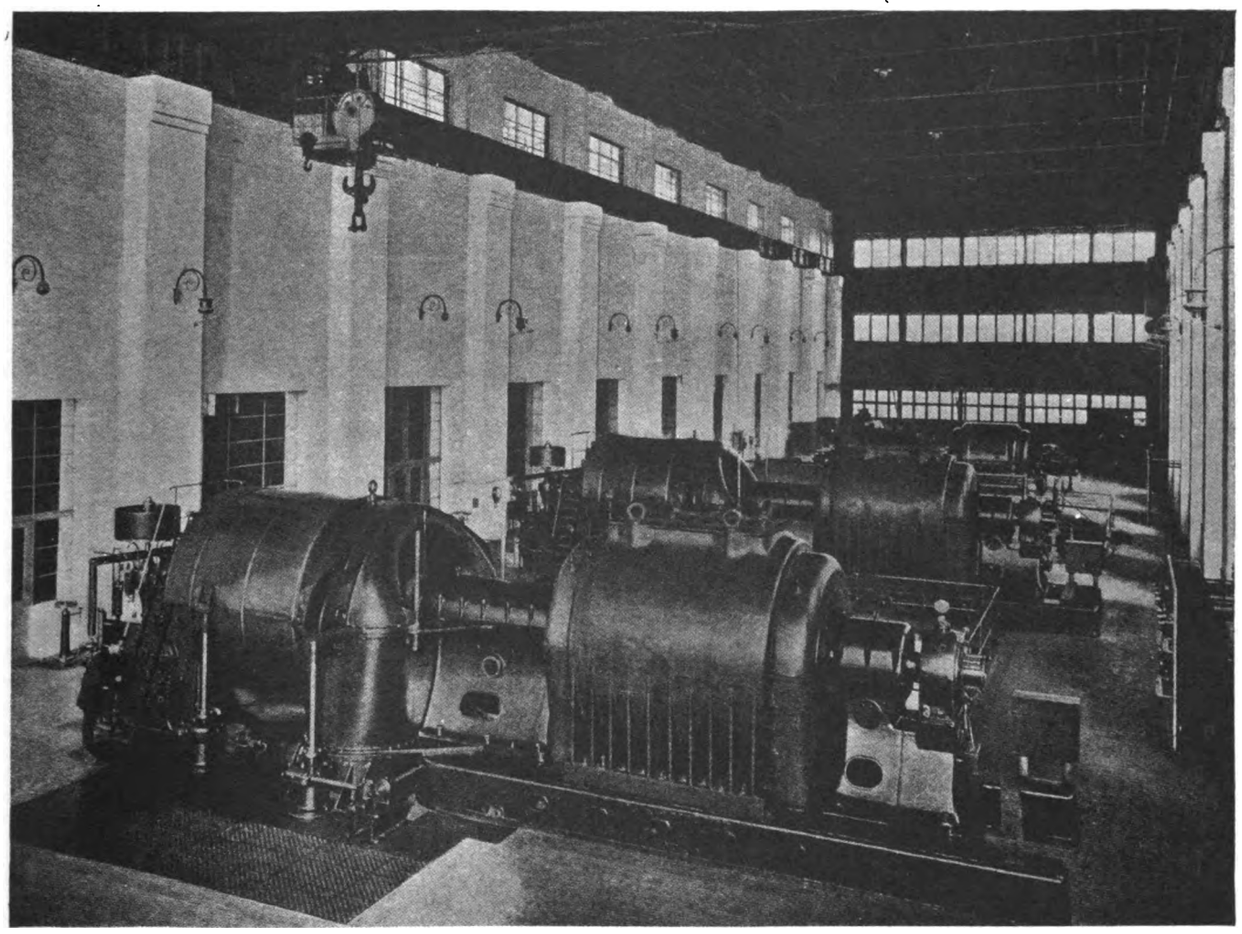

Fig. 6.—Interior of Turbine Room—White Bay Power Station.

Switch-house Details.

The conductors for the generator circuits and the busbars are of four-inch by one-quarter inch bare copper bar, while fifteenth-sixteenth diameter copper tube is used for the auxiliaries transformer circuit, and the connections from the feeder switches to the knife switches at the trifurcating bells of the underground paper-insulated lead-covered cables. These knife switches are so arranged that each feeder can be switched off its oil switch and directly on to the feeder test, or earthing, busbars. Each conductor is protected throughout by a brick channel on the wall or ceiling, and where conductors cross, as, for instance, in the case of the switch connections to the busbars, a brick wall is interposed. Each feeder group is equipped with a G.E. electro-static earth detector, and an aluminium surge arrestor, located over the feeder cable transfer pits. There are two of the latter extending the full length of the switch-house, with connecting openings every 4 ft. 6 in., thus furnishing protection for transfer cables, for which shelves are provided. American General Electric porcelain insulators are used throughout, those carrying the busbars being of special design to permit of expansion and contraction. The busbars of the three phases are arranged vertically in each case, with 3 in. concrete dividing slabs. The risers for the feeder bus and transfer bus dividing switches furnish a passage-way in the bus room between the sections of feeder bus and transfer bus.

The high-tension switches are of the American General Electric motor-operated H-3 type, contained in cubicles, having glazed ends and Keene's cement faced bricked sides, treated with Toch's white enamel. The doors are suspended so as to be self-closing by gravity, and to open and release the air pressure in case of explosion. To provide a still more rapid

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escape the upper portion of the door is furnished with light double doors on vertical gravity hinges.

The capacity of the generator, group, and selector switches is 1,200 amperes in each case; that of the auxiliaries transformer and feeder switches being 300 amperes.

The control room is situated on the upper floor of the switch-house. The operator's desk is centrally situated between the generator bench boards and a semi-circle of feeder panels, so that all the indicating instruments are presented to the operator's view. The remote control pull switches on the generator board are arranged on a mimic bus system, with the usual illuminated repeater signal lamps furnishing an immediate indication to the operator of the proper movement of the high-tension switch, and also presenting a continuous indication of the position of all switches. Each generator panel carries its own generator, auxiliaries transformer, selector, group, and feeder section switches; the synchronising receptacle, turbine governor control switch, the exciter field control, and the engine-room telegraph; also the main, excitation, and auxiliaries ammeters; the voltmeter, power factor meter, and indicating, integrating, and graphic recording watt meters. The board is also furnished with duplicate synchroscopes and a periodicity indicator. Each feeder panel carries the switches and ammeters for four feeders; two feeder panels thus corresponding to each generator bus. The feeder integrating watt meters and time limit relays are mounted on a secondary panel at the back of the feeder panel, the space between the two panels being kept clear to provide access. The wiring from the control board to the high-tension switches is run in steel conduits concealed in the concrete floor above the switch-room. There is an auxiliary service direct current board, carrying the switches and instruments for the lighting, the two 120 kilowatt motor generators, the two 12·5 kilowatt motor generators for the remote control service, and the batteries and boosters.

On the control floor are also the battery-room, containing the emergency battery and the switch-operating battery; the battery booster room, the test room, and the electrical superintendent's office and the staff accommodation. Immediately beneath the main switchboards is a mezzanine floor, giving free access to the control system connections, and accommodating the resistances.

In the lighting of the building, arrangements had been made for the free use of the mercury vapour lamp, with the addition of the warmer rays of the flame arc, to give the desired normal colour effect. Owing to the war, however, it has been necessary to substitute incandescent lamps for the flame arcs.

Operating.

As regards fuel economy, the practice developed at Ultimo is followed at White Bay. Each coal is frequently analysed for fixed carbon, volatile hydrocarbon, hygroscopic moisture and ash, and the calorific value is also ascertained by a bomb calorimeter. Automatic recording gas analysers for measuring the percentage of CO_2 in the flue gases have been used at Ultimo since the year 1905. A permanent record of the temperature of the gases is furnished by the Roberts-Austin recording pyrometer, which gives continuous concurrent readings from any three of ten connected stations.

The ash is regularly sampled, and the percentage of the unconsumed carbon ascertained. The feed water is measured by means of Venturi tubes, each of which is connected to an indicating, integrating, and recording instrument. The condensate is measured by weir and V-notch recorders. The feed water of each boiler is also regularly sampled and tested.

There are gauges for furnishing graphic records of the steam pressure, and also of the vacuum maintained at each turbine. A baragraph records the barometric pressure for ascertaining the true value of the vacuum.

As already indicated, the completion of the White Bay power-house has been allowed to progress quite slowly for some time past, and it was not until last May that a full working equipment for ordinary operation was available. While there are sundry adjustments that have to be made before the best working conditions will be reached, the following figures of the actual service for that month will probably be of more interest than a statement of the claims of the manufacturers, or the results of test under ideal conditions.

Efficiency Figures and Operating Costs of White Bay Power-house for the Month of May, 1918.

Output in kilowatt-hours,	4,982,828
Maximum hourly load in KW.-hours	15,800
Maximum quarter-hourly load in KW.-hours ..	16,320
Used in power-house ..	2·1 per cent.
Load factor on one-hour basis	42·3 per cent.
Heat value of coal as fired	12,937 B.T.U.'S.
Lb. of coal per KW.-hour	1·934
Lb. of steam per KW.-hour (used by turbines)	13·93
Lb. of water per lb. of coal (actual)	7·44
Lb. of water per lb. of coal (from and at 212 deg.)	9·67
Efficiency of boilers, etc.	72·27 per cent.

OPERATING COSTS.

Salaries and wages—
£1,327 3s. 8d. .. 0·0639d. per KW.-hour.
Fuel, supplies, and stores—
£3,149 10s. 3d. .. 0·1517d. per KW.-H.
£4,476 13s. 11d. .. 0·2156d. per KW.-H.

The work of the department is done by the officers, with regard to whose services, while there are both cause and inclination to speak in the highest terms, the expression of my views might not appear in place.

ELECTRICAL TRADE OF BRAZIL.

Forty-two pages of valuable information are contained in a booklet on "The Electrical Trade of Brazil," published by the British Electrical and Allied Manufacturers' Association, of 36, Kingsway. The publication comprises a report prepared by Mr. John M. Glen, the Association's correspondent in Rio de Janeiro. Mr. Glen is the branch manager of Messrs. Mather and Platt, Limited, of Manchester and London. The Association acknowledges its indebtedness to him for his services, and to Messrs. Mather and Platt for allowing the report to be published. In urging upon principals the necessity of visiting the country, Mr. Glen says that they will then realise that the electrical business abroad is a thing entirely different from that within the British Isles. Manufacturers must train and send out men willing to follow a newer policy, and to collect for the application at home knowledge of the needs and preferences of the markets. A far more liberal financial system must also be instituted than has been current up to date. Lectures and books on how to trade with other countries will not give the manufacturer one-tenth of what can be gathered in a week's stay abroad. Branch businesses must be established in the country with the firm's own engineers.

Regarding railway electrification, it is stated that before the war projects were in hand for the electrification of several railways, and within a few years after the conclusion of peace it is possible that the conversion of various sections of five railways may be well under way. Under the heading of tramways, it is stated that the first electrical installation was introduced 25 years ago, and probably no finer system can be seen in the world than that of Rio de Janeiro. In this branch of electrical engineering there is ample scope for Britain, due principally to the fact that all systems utilise direct current, although alternating current is employed for transmission purposes from the hydro-electric generators

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TRACK SECTIONING IN ELECTRIC RAILWAYS.

By E. CAPONE.

In the construction of electric railways the sectioning and control of supply to the conductor rail has to be arranged to comply with traffic demands, and adapted to the conditions of the permanent way layout. The object of splitting up the conductor rail is to facilitate localisation of faults, and to arrange matters so that the disconnection of any portion should still make it possible for traffic conditions to be maintained without disorganisation. The whole scheme should embody the advantages of being carried out to a standard at all feeding, sectioning, and single line working points. The track layouts and position of operating cabins naturally will not be identical at the different points; but it is generally possible by a little adjustment of cable connections and placing of the conductor rail, to retain the same standard of connections with their respective location of gaps. This also applies to station layouts, junctions, and crossovers where the standard already decided on can be conformed to. This is very important, and much appreciated by the staff operators on the line, also the station officials, all of whom have but to learn once the layout at any point for single line working to be in a position to handle conditions at any railway station; and signal-men at isolating or feeder points are in a position to take control at any similar point along the line without having to study new conditions. On the most recent work of railway electrification the whole question was most carefully considered, and all track and traffic conditions assembled before a definite system of standardisation was prepared.

Feeding points, section switches, station layouts, and single line working were practically embraced, and each respectively adapted and brought to a standard. Signal cabins are generally located at busy points, and can often be conveniently used to take the switchgear, the signal operators being trained for the work. This is a most desirable arrangement, since these men have control of the traffic, and are familiar with the conditions. In facing a problem of this sort it is necessary in the first place to lay out each point of the line, showing cable connections and switchgear, and then to assemble a key plan from which the whole scheme can be followed from the feeding points to the effect of operating section switches and parallel running. It must be remembered that the most economical condition of running is to have the adjacent conductor rails linked together, and the circuit breakers should be arranged to meet that condition.

It is often necessary to feed sections separately, or section to section, as well as to arrange for the isolation of feeders and cross feeding, and it is advisable to have the system shown so that these operations can be carried out diagrammatically. Occasions arise at termini where conditions are somewhat different to straight line working, but the same system can be used in splitting up the lines. A simple terminus station is illustrated, and is given in the sectioning diagram (Fig. 1). Accompanying is an operating key diagram (Fig. 2), demonstrating its use. It should be observed how intersecting lines are arranged so that the break-down on one section allows an alternative route for the traffic. This is elaborated in some cases so as to give electrical facilities for alternative routes, where provision has to be made for isolating any section of converging lines. Obviously it is not possible to meet all and every condition of traffic emergency, but careful consideration will generally make a good, practical system of working obtainable. One should bear in mind that conformity in design is desired, and in order to attain this each complication of track should not be viewed as an opening for creating an exception on account of extra work or expense; but all means should be tried, such as deviation of cable runs, or altering positions of gaps, to meet each case, and retain standardisation. The breaks or gaps are preferably only made in the conductor rail where the natural intersection of the track necessitates an opening in the conductor rail. To break a continuous length of conductor rail not only requires cable, feeder pillars, bonds and ramps, etc., but makes an extra gap for the collector shoe to jump. For this reason a natural break, if within reasonable distance from the place, is more advisable, and it is often advantageous to run a length of cable and avoid making an additional gap at the spot desired.

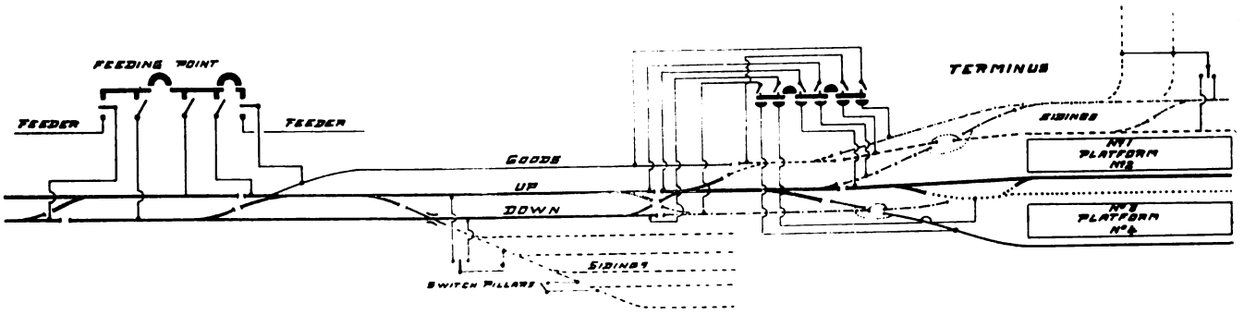

Fig. 1.—Sectioning Diagram.

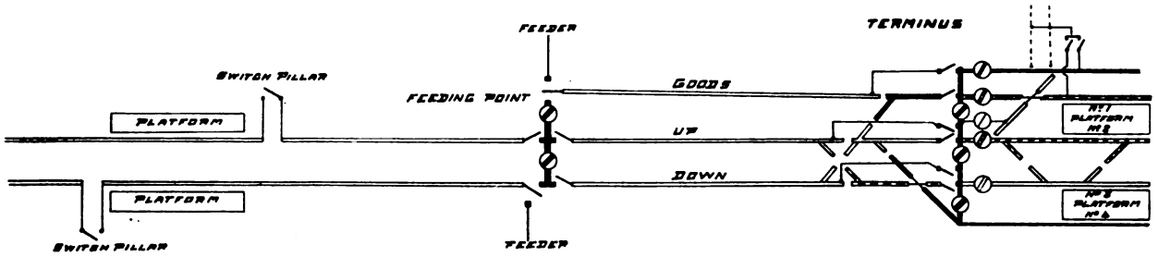

Fig. 2.—Operating Key Diagram.

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At railway stations crossovers are generally provided at each end of the platform to facilitate the shunting of trains locally from up to down lines, and in the layout for the electrification of a line provision should be made to deal with the electric trains in a similar way. At the same time advantage of the latter can be taken to make each such station capable of dealing with an electric train on single line working. How this is done is shown on the illustration (Fig. 3). The train can come up to the up platform and then cross over to the down line, and on to the up line again, as indicated by the arrows. It will be noted the faulty section has not been touched; this is an advantage in case of a breakdown on any section. This method of dealing with electric rolling stock is now in use, and rightly considered essential in working under modern traffic conditions. The isolation of the faulty section shown on the illustration is by opening switch B at the section point, and opening switch C at an intermediate station. The four-coach train can come up to the station, but must not proceed over isolating gap A; the train is therefore backed across to the down line, which it uses to continue its journey until reaching the first available crossover to get on to its correct track, and all oncoming up trains will continue working on this single line until the faulty section can be again put into commission. When this system is in vogue throughout, it gives invaluable flexibility in handling traffic, and it is one of the reasons that makes it advantageous to erect switchgear at the signal cabins, because the signal operator can communicate with adjacent points, and arrange matters immediately.

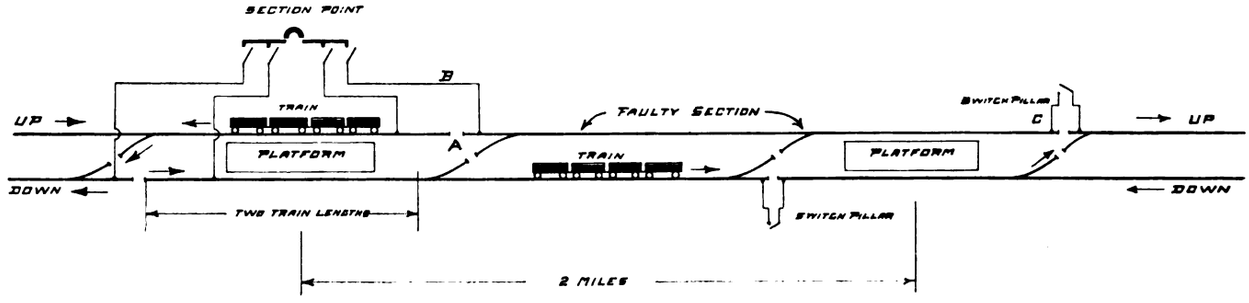

Fig. 3.—Single Line Working Electrified Lines.

A good arrangement of a section point is shown, and a simple feeding point is also given where it may be noted that the combination of switches is the same for the sectioning of the track, and gives all the arrangements for feeding and isolation generally required in practice. Throughout the up and down lines are run in parallel, but the precaution is taken of having a circuit breaker between them to give the security of rapid local isolation and automatically to cut out the faulty side. The latter is of importance, as otherwise a fault arising on one line would involve the other, and the time absorbed in locating it might cause serious dislocation of traffic. Use of the circuit breaker should be adhered to at all points throughout the system of switchgear.

It will be noted from the diagram of a feeder point (Fig. 1) that one feeder can be used for any section, or the feeders cut out, when the switches are used (as a section point) at the sub-station end. The feeders have circuit breakers in accordance with standard practice.

There is yet to be considered a terminus. It will be seen from the illustration that the conductor rail acts as a feeder to the station tracks, and each platform or siding is fed through circuit breakers; but the methods of arranging sections of conductor rail are only shown as illustrative of the ways and means of giving an available electrified track in the event of any trouble arising on a portion of the line. Sidings can with advantage be tapped off the conductor rail through a switch pillar, and only made alive when in use. In some cases, where sidings are of special importance, two means of supply may be deemed necessary, in which case a tapping can be taken off up and down lines.

The sectioning diagram of a line (Fig. 1) gives a general idea of what may be considered good practice. Of course elaborations can be introduced, but considering the work that has to be done to answer certain requirements, it would appear that any radical alterations could hardly tend towards simplification or give any practical advantage, especially when the men called upon to operate or maintain have generally to work under conditions where complications are least desirable.

To assist in the efficient operation and training of men to become familiar with their work a great advantage is found in having a large size diagram of each point, and having it erected where it can be seen when operating the switchboard. The work expended is well repaid, especially at rush moments, when men not familiar with switchboard operation are suddenly called upon to telephone instructions. It has been found useful to have the diagram operated in conjunction with the switchboard. The run of connections and bus-bars are shown in a bold and simple form, and the switches and circuit breakers are represented by discs, so that the connections can be seen at a glance. One method is to paint the connections on the front of the switchboard, but this is not so easy or convenient for reading as a separate diagram.

Carrying the use of diagrams a stage further, the distributing engineer will find great assistance from an operating key diagram showing the whole system in simple form, mounted so as to admit of movable pieces to take the place of switches or circuit breakers; this on a large system is indispensable, as it enables one to follow rapidly a reconstruction in distribution, and saves a lot of trouble when rearranging methods of feeding. It can also be used as a key, from which instructions can be issued in a few minutes, and it also presents a record of the connections in use from time to time. When trouble arises, the time element is usually of importance, and the means of obtaining data on the spot not always available, hence a diagram of this nature is so useful. A point of some importance, making for simplicity and standardising, is to arrange the switches for up and down lines on the same side of the switchboards; operators facing the boards anywhere on the system should always have the advantage of knowing that this condition applies throughout, and in cases where boards are on different sides of the line or reversed in the cabins, the cable connections should be adjusted so as to keep all boards arranged in the system described.

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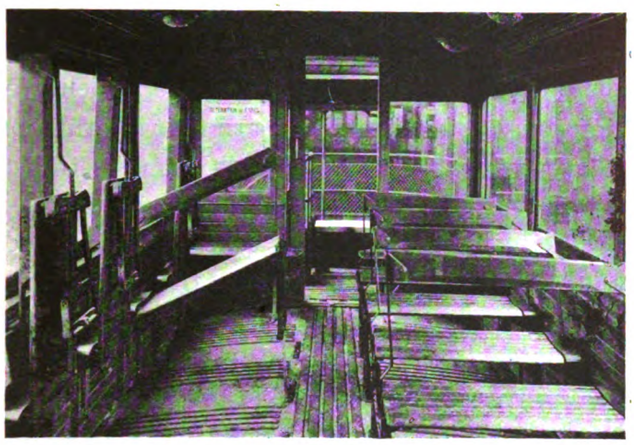
AN UNOBSTRUCTED FLOOR ON THE TOP DECK.

The greatest achievements in modern engineering, and the most efficient machines, are the results of successive improvements in small details, each inventor adding his quota to the whole. A tramcar is the product of many minds, and it is being constantly improved, both in equipment and in seating accommodation.

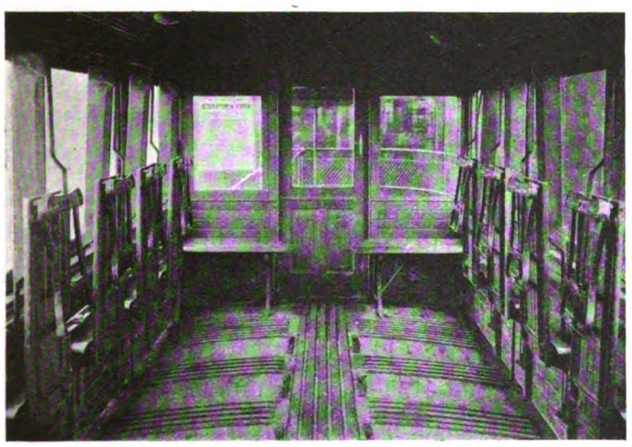
The accompanying photographs illustrate a seat that was designed by Mr. E. S. Rayner, borough electrical engineer and tramways manager of Doncaster,



Seats in Position (on right) and Raised (on left).

a few years ago, and which has been in use on the Doncaster cars for nearly five years. Mr. Rayner designed the seat with the object of making it more convenient for the cleaners to do their work thoroughly. When the seat is raised, as will be seen from the photographs, there is an absolutely unobstructed floor on the top deck, and it is a comparatively simple matter to clean the dirt from the corners.

The seat does away with the pair of legs at the outside edge of the car top, usually a source of trouble



Seats all Raised, giving Unobstructed Floor Deck.

from the number of screws that had to be put in the feet, and it was continually necessary to renew the outside board of the floor on account of rot setting in owing to the wet dirt and the difficulty of cleaning it away. As will be seen from the photographs, the foot of the side support of the seat engages in a pin.

The seats have been adopted at Sheffield and Ilford, and have been found to be of considerable advantage. Further particulars may be obtained from Mr. T. Potts, Greyfriars Road, Doncaster.

THE B.E.A.M.A. ANNUAL MEETING.

The annual general meeting of the Association was held at the offices, 36, Kingsway, London, W.C.2, on March 20, 1919, Mr. F. R. Davenport, chairman of the Council, in the chair.

The chairman, in moving the adoption of the annual report, reviewed the war period, recalling to his audience the sacrifices, personal as well as financial, which were made to secure a permanent peace. He dealt with the many transition questions which would continue to confront the electrical and allied industries before a resumption of normal business could be expected, of which the chief were Labour, the export trade, and the much debated question of the future fiscal policy of the Government. The accounts and report were adopted.

The chairman announced the result of the election to the five vacancies on the Council, as follows:—The British Westinghouse Electricity and Manufacturing Company, Limited; The D.P. Battery Company, Limited; Electromotors, Limited; Lancashire Dynamo and Motor Company, Limited; Nalder Brothers and Thompson, Limited.

Messrs. Price, Waterhouse and Company were re-elected auditors of the association for the year.

During the course of the proceedings, the chairman said that it was with great personal regret that he judged it necessary to resign the office of chairman, which, owing entirely to their goodwill, it had been his privilege to hold for five consecutive years. He was inspired to that resolve solely by the fact that he had held the chairmanship so long, and the expediency, in most undertakings, after such a period, for making way for someone else. He had the great satisfaction of knowing that his successor, whoever he might be, would find himself in charge of a real live organisation, with a loyal and energetic staff equal to any call made upon them. There was no reason to anticipate anything but greater successes still for the Association in the future, and he hoped to be still in close touch with all its work. In conclusion, he thanked the members for their courtesy to him on all occasions and the staff for their loyal service. His relations with everyone had been, he was happy to say, of the most cordial kind.

Mr. C. P. Martin (C. A. Parsons and Company, Limited) and Mr. John Taylor, O.B.E. (Mather and Platt, Limited), in respectively proposing and seconding a vote of thanks to the chairman for presiding, spoke of the great regret with which they had all heard of his determination to vacate the chair He had been in every way an ideal chairman, doing a tremendous amount of work and extending to all comers the greatest consideration and courtesy.

The vote of thanks having been passed with acclamation, the proceedings terminated.

[At the subsequent meeting of the Council of the Association, Mr. W. O. Smith, managing director of Elliott Brothers (London), Limited, was unanimously elected chairman for the year 1919.]

Council's Report.

The report of the Council for the year 1918 contains an impressive record of useful work. Each paragraph in the seven closely printed quarto pages covers a wide range of activities. A summary is given of the labours of the Export Committee in connection with imports and exports restrictions, and the action of the Council in regard to British trading interests in South Africa, Argentine, Australia, Japan, Switzerland, Brazil, Scandinavia, and other parts of the world. In home affairs, the Council naturally took a very active interest, dealing with the Board of Trade classifications of imports and exports, the report of the Ministry of Reconstruction Engineering Trades (New Industries) Committee, precedence of post-war work, pivotal men, report of the Board of Trade Committee on the electrical trades after the war, and other such matters. The Council also accepted invitations to express opinions on the proposals for the erection of super-power electrical stations, and to send representatives to those bodies dealing with the disposal of unconsumed war stores, national kitchens, and electro-culture, and to the Joint Committee set up by the Electrical Engineers' Institution for the creation of a national proving house. The Council has promised support to the Electrical Development Association, the object of which is to educate the public in the uses of electricity by means of publicity. Education and research continue to engage the active attention of the Council, and the Education Committee's report will be issued at an early date. Standardisation, E.E.I. conditions of contract, Port of London conditions of contract, conditions of sale, and other matters affecting the financial interests of the electrical trades have come under the consideration of the Council. Cordial co-operation between the Association and the Institution of Electrical Engineers is maintained. The Council reports with satisfaction that the *Journal* has carried on successfully during the war and has maintained its circulation and influence abroad. The demise of Mr. James Callender, a member of the Council, is recorded with deep regret. The number of members on the register at the end of the year was 216. Forty-five firms were admitted to membership during the year, and three resigned. A table showing the attendance of members at meetings of Council during the session 1918, concludes the report.

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THE EDITOR will be glad to consider articles by experts. All information of a practical character relating particularly to the engineering and operating branches of transportation will receive prompt attention. Original illustrations will also be welcome.

LONDON, APRIL 10, 1919.

The Eight-Hour Day.

As a result of much agitation, the representatives of tramway authorities and tramway workers were brought together for consultation on the wages earned and hours worked by tramway employees. After a lengthy period of private negotiation, an agreement was drawn up and accepted by both parties, fixing the number of hours to be worked and the wages to be paid. The full text of the agreement is published in another column of this issue. In the absence of a report of the prolonged deliberations between the three bodies who negotiated the agreement, it is impossible to clear up two interesting points. In other industries a great deal has been said of the desire of the workers to participate in the benefits of what is termed "a fuller life." Nor have they been backward in urging that the shorter working day will benefit the community by leading to the employment of more men. Both objects are commendable, but the conditions of public passenger services have confronted the best-intentioned employers with obstacles that have hitherto proved insurmountable to a reduction of hours of working. The solution has now been relegated to a multitude of counsellors, in that under the agreement the question of spread-over time is left to each undertaking to confer thereon with the representatives of the trade union, with a view to reducing it to the lowest possible minimum. As the consideration of this matter is to be brought forward again for discussion by the national representatives not later than July 1, the officers responsible for the general deliberations may be interested to learn that information of apparent value is obtainable from Australian tramways. Those undertakings have enjoyed the eight-hour day for a considerable period, and in Sydney and Melbourne the spread-over time difficulty is said to have been largely eliminated. That, at least, was the assertion made by the Perth (W.A.) tramway employees on the occasion of a strike last Christmas for the purpose of getting their minimum rate of pay increased to nearly the same figure as is enjoyed in the cities already named. A further grievance was made of the question of broken time being spread over so many hours that the men had little or no opportunity for recreation. It is to be feared that in this country the payment of war bonuses will affect the question of spread-over time. While the bonus exists the men will probably be found not to object to lessened facilities for overtime pay, thus giving scope for engaging more workers. When the bonus ceases they may be desirous of more overtime. To some extent this possible trouble should be eased by the provision that the employees are to receive 54 or 57 hours' pay for the 48-hour week, according to the duration of their old working week. The most satisfactory feature of the agreement is that the unions now recognise that the working expenditure cannot be increased without further calls upon the passengers who keep the undertakings going. In view of what has been done for railwaymen and miners, it is certain that the Board of Trade will not withhold authority to increase the fares, failing which sanction the new conditions are terminable on one month's notice from either side.

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Tramways Finance. Interesting considerations arise in connection with the decision of the Minister-designate of Ways and Communications to exclude municipal tramways from the Bill. As far as can be gathered from his remarks, Sir E. Geddes' action is, at least, partly due to his discovery that "taken all over, these undertakings are earning 7 per cent. on their capital." The only sense in which this statement could be substantiated is by taking the balance between gross receipts and expenditure; when the necessary reductions have been made to meet all liabilities it is doubtful whether the average return spread over the whole of the undertakings reaches 3 per cent. Extending the investigation to individual undertakings, many will be found to earn insufficient to provide for renewals, while some municipal authorities are forced to levy a rate to meet deficiencies. As for company undertakings, which are not handicapped by having to provide an annual instalment for the repayment of their capital, their dividends also fall far short of the aggregate earnings attributed by the Minister to tramway enterprises. Why privately owned lines do not appear to show such good results as some municipal tramways may be inferred from the report of the Board of Trade Committee which inquired into electrical industries. The obstacles therein revealed account for some hindrances that also beset municipal undertakings. The task of removing these undesirable conditions cannot be successfully carried through without resort to Parliament, but as company tramways are to come under the new Ministry, we may assume that the latter body will undertake the initiation of this item in the reconstruction programmes. This particular work is one that need not await the great scheme of placing the electricity supply upon a national basis, which will be of benefit to both forms of tramway enterprise. A considerable time must also elapse before any visible results come from the inclusion of company tramways under State supervision, but there is one respect in which the effect should not be long delayed. That will be in the form of extensions of a rural and inter-urban character, which will be made urgent by housing and agricultural needs. Presumably it will no longer be necessary to pass Bills through Parliament to secure sanction. The Ministry, no doubt, will have power to promote and deal with such proposals, possibly after a local inquiry such as is now held by the Light Railways Commission. This is a matter in which municipal tramways will claim to share in the advantages which the existence of the Ministry will confer. It is conceivable also that the new Department will be able to facilitate experiments in the transport of goods. While strong arguments may be adduced for not seeking to force the municipalities underneath the wing of the Ministry, there are directions in which tramways stand to gain from a co-ordination of railway and tramway interests. The idea is not a new one, for it has long been realised in two Australian States.

Board of Trade's Future. Officials connected with railway, tramway, and electricity undertakings will find their relations with the Board of Trade at an end when the Ministry of Ways and Communications is established. Those relations have been more intimate during the last four years than at any period since electric traction came into being. Early in the war the Board were empowered to grant provisional orders without delay. Although the need for national economy caused the great majority of extension schemes to be deferred until after the war, there were tramway and power projects rendered necessary by war work that were facilitated by the reformed procedure. Then came the appointment of the Board of Trade Committee to inquire into electrical industries, and finally the committee of tramway managers who were charged with the task of attempting to imitate with tramway supplies the miracle of the loaves and fishes. The connection of tramways with the Board of Trade dates from the Act of 1870. As in the case of railways, the Royal Engineer officers who have acted as inspectors of new construction and conducted inquiries into car accidents have discharged their duties admirably. Whether R.E. officers should continue this work, or future vacancies be filled by the appointment of railway and tramway engineers, is a matter that no doubt will engage attention. The railway department was created in 1840 for the purpose of inspecting railways before they are opened for traffic, to inquire into accidents, to

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approve by-laws, and generally to take an active part in all matters which in any way affect the public. Similar duties were allotted in the case of tramways, and in the closing stage of the war an additional task was imposed, namely, of hearing applications for increased fares. The Board, as the first Government Department to deal with Labour matters, has also been concerned in the settlement of disputes on railways, and when the present Prime Minister was its head, in 1911, he had the distinction of introducing the Conciliation Board scheme for the settlement of the great strike. A similar scheme was open for adoption by tramways, but the London County Council undertaking appears to have been the only one by which it was accepted, notwithstanding that it was representative of all grades and secured important concessions, without disturbing harmonious relations. When in November, 1917, Sir Albert Stanley, as an expert in electric railway and labour direction, was called to the Presidency of the Board of Trade, there is no doubt he was soon convinced of the need for the separation of its activities. These have been frequently added to since its establishment in the reign of James I. as a purely trade committee. Sir Albert Stanley's reforming hand has already worked a transformation in its usefulness as a consular commercial agency at home and abroad, and this department alone will prove a monument to his labours when the Board is given the title of the Ministry of Commerce.

Obstructions on London Tramways.

The other morning, a crazy coal-cart broke down across the track on a busy tramway route in London. It was two miles from the centre of the City, and within five minutes the line was blocked for about a mile with stranded cars, and soon the pavement was crowded with hurrying people. A few moments would have sufficed for the drivers and conductors of the cars to remove the obstruction, and the question is naturally asked why they stood idly looking on. The answer is, that they dared not touch a single ounce of the obstructing coal without a mandate from the police authorities. That is the law, and the whole incident is an instructive parable. London County Council Tramways development is obstructed and hampered at every turn by rival authorities and hostile interests. The Metropolitan Police hold power to restrict, divert, or stop tramway traffic at any moment and at every place. Licences for drivers and conductors are granted by the Metropolitan Police, and in numerous other important details they virtually control the operation of the tramway services. Nor are these the only obstructions with which the London County Council Tramways Department have to contend. Scotland Yard is formidable and forbidding enough, but its opposition causes little expense directly. It is otherwise with the hostility of the City Corporation, suburban borough councils, and the various vested interests which have made "dead ends" of many routes, taxed the undertaking with heavy charges, and otherwise rendered operation of the services costly and difficult. At the present moment, the Bills being promoted, seeking powers to carry through improvements urgently demanded, are encountering opposition which it will take thousands of pounds to overcome. London industry and commerce have absorbed the tramway services into themselves and made them vitally necessary to their continued existence. Yet this vital necessity of the greatest city in the world, this interest of a community larger and more powerful than many a nation, is constantly obstructed by hostile interests, subjected to the petty domination of a policeman. London County Council Tramways Authority is called upon to administer a public service of such vast importance, and yet is denied the right to hold rule in its own domain. If power confers responsibility, surely responsibility should confer power to discharge the duties entailed. It is more than time that the obstructions to the development and proper administration of London tramways should be removed and due authority conferred upon those who have the duty of carrying on the business. Here is no question of endangering democratic control, but quite the contrary. London County Council is elected by the ratepayers of London, and therefore commissioned to express the mind of the community. The Council therefore ought to possess unrestricted authority over the whole area served by the tramways, or at least be freed from the interferences and opposition which obstruct the operation and free development of the services.

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THE WAYS AND COMMUNICATIONS BILL.

The Way Smoothed by a Concession.

The much-advertised campaign of opposition to the Ministry of Ways and Communications Bill shrank to very small proportions when that measure came up for the second reading in the House of Commons on March 17. This was largely due to the temperate and convincing statement of Sir Eric Geddes, who introduced the Bill, and by one important concession removed the most serious objection that had been widely felt by members and the public. As a result the Government were able after a two days' debate to secure the second reading without a division. The main principle was thus approved, and the discussion on the Committee stage began on March 27.

The important concession referred to above was the deletion of a part of clause 4, which would have enabled the Ministry simply by means of Orders in Council to acquire railways and other transport undertakings. In consequence of that deletion, the Government will have to promote and carry through Parliament special Bills for any one of these purposes. Thus full and continuous Parliamentary control of the expansion of the powers of the Ministry in this direction is retained.

Sir Eric Geddes had a full house when he moved the second reading of the Bill in a speech occupying an hour and a half, which was well received. It was a plain, practical statement of the transportation problem with which the country is confronted, and it had the unusual result of convincing a number of members whose original intention had, on their own confession, been to vote against the measure.

In introducing the Bill, Sir Eric Geddes said that the problem which we have to face had, he thought, brought before the country as never before the importance of transportation to a highly organised state. We realised, perhaps, in the last year or two that without a go-ahead system, a vitalising system of transportation, the health and housing of the people, agricultural development, settlement on the land, and the industrial development of the country could not possibly be achieved. Housing as a whole was added to those reforms. We were going to make such demands upon the transportation system of the country as had never been made before, and it was right at this stage to consider the conditions, both financial and physical, of the machine upon which we were going to make these demands.

"Except in the one bright instance of the municipal tramways, the transportation systems of this country to-day are not prosperous. There are 279 tramways undertakings in the country, of which 96 per cent. are electrified. That is an important point. It shows that these undertakings are almost entirely modern. Taken all over, these undertakings are earning 7 per cent. on their capital. They are excluded from the Bill. Let us take railways. Before the war the return on railway capital expenditure was 4·3 per cent. It is a loss of from 3 to 4 per cent. on to-day's figures. Light railways before the war made a profit of 2 per cent.; to-day they are working at a loss. Canals, excepting the great Manchester Ship Canal, before the war earned 1½ per cent.; to-day they are working at a loss, and they are heavily subsidised. Roads have practically no income. They cost the country £20,000,000 a year."

The Railway Situation.

Turning again to railways, the Minister said that they were now being worked at a loss of something over £250,000 a day, or £100,000,000 a year. For two years the Government were pledged to continue the guarantee to the railways. Other forms of transportation had either been subsidised or had been given large additional powers of charging. They ought all to be got back to a paying basis. To do that order must be evolved out of chaos. The Government had come to the conclusion that some measure of unified control of all the systems of transportation was necessary. It appeared almost inevitable that to a greater or less extent we must forgo the luxuries of competition; we must forgo private interest and local interest in the interest of the State. In the past private interest made for development, but to-day it made for colossal waste.

Having referred to unnecessary movement of goods on the railways, and to the fact that it was not to the interest of dock authorities to improve their accommodation when the advantage was going to the conveying company, he said that the Government had been forced to the conclusion that, in addition to eliminating competition and restricting the freedom of private enterprise and management, the transportation agencies would be comparatively barren in economy and development until unified control was brought in. It would be nothing short of criminal to let the old system of competition go on. In regard to labour, if they expected discipline among the trade unions they must give the Government a say in the conditions under which labour worked.

"It is no use piling burdens on the railway shareholder. He is not a malefactor. He deserves fair treatment, but he cannot pay any more. He cannot pay what his bill is to-day. We have got to help him. The State must come in and make economies possible.

"Is nationalisation a cure? I do not know. There are those who look upon nationalisation as an end in itself, as something desirable. I am not one of those. I look upon nationalisation as a possible means to an end, a means to an end which you may have to adopt with its disadvantages if the advantages which it secures outweigh them. It is essential in transport that you should ensure continuity of the service, and you cannot have unreasonable stoppages. You must ensure an adequate and efficient service, and if you cannot get that by means of private management, then nationalise."

In regard to the suggestion that railway rates should be put up to meet the present deficit on railway working, he said that that would mean a 70 to 80 per cent. increase on goods rates, and that was unthinkable. The economies which could be effected with a certain amount of unity of control were estimated at about £20,000,000 a year. There was one way, he thought, in which the deficit could be progressively met, and that meant drastic and courageous treatment as a whole. They must introduce economies which were only possible when a comprehensive scheme of settlement could be carried out, and carried out compulsorily if necessary, when they could standardise throughout. Standardisation saved in every way.

Economy of Electric Traction.

"Perhaps the greatest saving of all is the introduction of electricity into our haulage, not electricity such as is used in the multiple-unit system on the tubes around London, but electricity used with heavy electric locomotives. They have been experimented with, and with great success, but we must not commit the folly of our predecessors and allow the development of every system on its own principle, of every system according to the whims and notions of those who introduce it."

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Sir Eric proceeded to speak of the economies possible by traders dealing more rapidly with wagons and by reducing to a minimum the amount of hauling of empty wagons. For the latter purpose the Government would acquire all the privately-owned wagons.

LIGHT RAILWAYS.

"Coming to light railways—they are a comparatively small thing. There are only 836 miles of them. They only earn 2 per cent. Many were authorised, but were not built because they could not be built and be financially successful. Their expenses have gone up, and I think there is no doubt that to-day they must be working at a considerable loss. Their expenses have not gone up as high as on the main lines, but they have gone up very materially. Those railways have been put down with no policy; they are dotted all over the place, and really sometimes one wonders why they are there. They have had nobody to advise, and thus all of us who have been interested in and studied railways all our lives know that they simply go there and eventually become ripe plums to drop into the mouth of the big lines. They cannot exist by themselves, and already I am receiving applications from all sides for advice. They know that I have got a certain number, a small staff, of technical experts, who are helping me, and I am asked for advice on all sides about these undertakings. It has been suggested that the sixty-centimetre Decauville organisation in France might be brought over here and with advantage spread like a network over the countryside. But the maintenance and cost of a Decauville track is so heavy that to put it down in this country for agricultural use would simply be throwing away money. I think there is a possibility of developing the light railway as it has been developed in the rich districts of Northern France and Belgium. I think there is a possibility of developing light electric railways for inter-urban traffic. Decauville railways strewn all over the country, and run by farmers, is a dream. It is a thing that will never exist successfully."

MOTOR TRACTION.

"I think that we must look to the development of motor traction for our agricultural areas. You have there roads of a capital value—I do not know what, and I do not know that anyone knows, but they cost some £20,000,000 per year. Can anyone say that we are getting any value, any return, from that £20,000,000? I do not say you should spend it and look exactly at what return you are going to get out of it, but are we making the best use of property on which £20,000,000 per year is spent? I doubt it very much, and we cannot afford two blocks of capital where one will do. Roads have a greater possibility in opening up these districts than any light railway I have ever met. In this country, for one thing, we do not get the great level stretches we do in France. None of these light railways, I must say, are well equipped. With road conveyances the maintenance will probably be very little higher for dealing with seasonal traffic, whereas if you put a railway down you have got to keep it going all the year. Road services are flexible, and you can move them about, but you cannot move your railway about. When I see the ingenuity with which the motor interest is opposing this Bill, and when I see the picture of the octopus, I wonder what their conception is of a Ministry of Transportation! We had it in France. We had the Rolls-Royce driver in France, who wanted a beautiful smooth road, and we had the Army Service Corps, who said they would be put out of business altogether, but it did not do it. The roads proved there that they were all right, and with your enormous road system in this country I ask the House, when you are going to have a Ministry of Transportation, would it not be criminal to leave it out?"

Sir Eric Geddes subsequently dealt with canals and docks, and pointed out the value of unification of administration, and then referred to electricity supply.

ELECTRICITY SUPPLY.

On this subject he said:—"At first, I agree, it appears a little illogical to put electricity into the purview of such a Ministry as this. But I would ask the House to endeavour to follow me in the conception of transportation which I have been endeavouring to put before them. Transportation is not merely carrying something from A to B. Transportation is the greatest power that we have for bringing prosperity to the community and for developing the district served by it. Is it thought for a moment that a transportation authority would disregard the industrial development of the district through which its lines go? While they were competitive it really was not worth while their making very special efforts to attract trade, because the other men got it as much as they did, and they went on competing. But in the districts where there has only been one big railway system a great deal has been done to develop industry, to attract new industries, and to push the industries of the district. In everything that makes for the prosperity of the district itself it is in the interests of the transportation agency to push it, to take it up, to help it, to foster it; and to suggest that a transportation agency with electricity, of all things, would desire to penalise the manufacturer can only be put forward by anyone who does not understand really what we are after. Everyone knows that the greater the load, the more diverse the load, on a power-station, the cheaper is the power, and the cheaper the power the greater the advantage to the railway that is electrified. It is estimated conservatively that when we get through the electrification of the main lines, which should be done and done promptly—and it will be undertaken if this Bill becomes law—full 20 per cent. of the electricity of the country can be used for traction. But it is not only in reducing the price of the current that we get an advantage. The greatest advantage of electricity is in getting greater density of traffic over the line, so that there is a still further advantage in developing the district that you electrify, and if you consider that the lines of railway are the most direct, the safest, and the easiest of access for the high-tension cables, that it is in every way in the interests of the railway and the transportation agency and the Transportation Ministry to get the electricity pushed down the lines and spread out into the industrial areas, it is really a fallacy to suppose that it would be against the interests of the railways to develop the industrial use of electricity, and far less against the interest of the Transportation Ministry as a whole. The difference between the co-operative use and co-operative production of electricity is enormous, and there is no district in this country where electricity is better organised to-day than the North-East Coast. There the electric power company has worked hand-in-hand with the North-Eastern Railway. There we have a joint organisation—I was instrumental in setting it up—for attracting industry to the district and developing industry in the district. We jointly went in for placing the power-stations near the coal mines and developing the economic use of waste heat. You may say that was against the interest of the railway, but it was not, because it developed the prosperity of the district, and it is in that spirit, and that spirit only, that we must look at this question."

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The Government Proposals.

In dealing with some of the provisions of the Bill (the text of which was published in our issue of March 13), Sir Eric Geddes said that the temporary powers would all lapse at the end of two years. They could only arrive at a considered opinion after they had carefully and technically examined the possibilities of each class of economy. During the two years the Ministry must have the power to initiate, and, if necessary, to carry through reforms. But until the railways had been told authoritatively and definitely either that they were to go back as independent concerns or that their interests were going to be fused, and they would never go back as independent concerns —until they had been told that, it was not possible to get even the commencement of the economies.

"During the two years we must endeavour to lift the dead hand which is on development. We must endeavour to help it, and help it along heartily, while we are considering the question. At the end of two years the powers under clause 3 lapse, and we shall have to come back to the House. It was not proposed to take any permanent action by Order in Council. Any Order in Council would be discussed in the House. (Hon. Members: "No.") It was thought that that would afford reasonable facilities. But in view of the fact that there is undoubtedly a strong feeling in the House against that procedure the Government will now amend clause 4, eliminating the procedure by Order in Council. On the other hand, dealing particularly with the provisions of clause 4, sub-section (1), paragraphs (*e*) and (*f*), as regards (*e*) the Government will definitely seek power in the Bill to acquire, by purchase or hire, and to maintain, work, or lease privately-owned railway wagons on terms, failing agreement, to be settled by the Railway and Canal Commission under the provision of clause 3, sub-section (5) of the Bill as to temporary arbitration powers. The Government will also seek under the Bill powers to prohibit the use of privately-owned wagons in future, except under licence. It is also proposed to transfer the powers in clause 4, sub-section (1) (*f*), which were permanent powers, and make them temporary powers under clause 3, and to provide that, in addition, during the two years the Minister shall have the right, subject to Treasury control, to construct such works as may be necessary. That is really essential if we are to have legal powers to carry out the scheme—it may be railway development, or something of that kind, which we could not reasonably expect that existing railway companies or other transport agencies would undertake. The Government will have to seek powers at the end of two years to deal with the whole question of transportation. As regards Ireland, it is proposed there, on account of the social and geographical conditions which obtain, that we should set up in Ireland, as part of the Government organisation, a branch of the Ministry which would deal with all Irish questions there. All local matters of purely local interest will be dealt with there. If matters of great importance have to be discussed, it will be the intention of the Minister, or the senior high technical officer, to go over to Dublin to discuss them."

An Hon. Member: "Is it the same with regard to Scotland?"

Sir E. Geddes: "No. Then as regards railways during the two years, we shall continue some such organisation as existed during the war. It is, of course, early days to say how you will organise the railways in the future until you decide the exact form on which they will be worked, but if, as I think is inevitable, there is bound to be a certain amount of central control and unity of control in London, it will probably be found that the best way will be to set up a Chief Commissioner, with possibly other Commissioners here, and divide the country into zones—non-competitive zones —having District Commissioners, partly elected from the district, partly appointed by the Government, and partly drawn from Labour."

Mr. Thomas: "I want to ask if you are disbanding the Railway Executive? Do you mean the Commissioners that you are talking about to take over and exercise the functions of the present Railway Executive?"

Central Control.

Sir E. Geddes: "The present Railway Executive, or, as I have endeavoured to explain, some body more or less like it, so long as the companies remain in their present position, will have to continue, and in the future, when we reach the more permanent state of railways and of the transportation of the country generally, I think some body of Commissioners will be necessary. I do not think it would be a possible proposition to manage the railways or the transportation direct from the Ministry with executive powers—quite impossible. As regards docks and harbours, there I think it would be a fatal mistake in any way to give up the invaluable services which those great port authorities have been performing, but I think it is essential that some kind of central control, looking at transportation as a whole, should have a right to say to them, 'This improvement is essential in the interests of the community as a whole. It may not be of local interest, but it is essential in the interests of the whole community.'"

Regarding dock administration, he said that the port authorities should have some central body in London. The canals also would have to be dealt with by a Commission. He thought they would be better removed from the railway interest.

Roads—A Separate Department.

"As to the roads," he continued, "I would propose—in fact I have arranged if this Bill becomes law—that the roads shall be a separate department of the Ministry. The position of local authorities is in no way altered. They will deal direct with the Roads Department in exactly the same way as they dealt with the chairman of the Road Board in the past. I am glad to say that that great road maker to whom the army in France owes so much, and who served under me there, Brigadier-General Maybury, not only is in favour of this arrangement from the point of view of the roads, but has consented to serve as head of the department. He will, under the organisation, have direct access to the Minister."

In conclusion, he said:—"It is upon these lines, and with this conception, that the Government propose to plan and to build. It is admitted that the Bill is far-reaching, that it gives great powers, that the situation, as I have endeavoured to show, is serious, very serious. I do not think it is desperate if it is tackled properly: I do think it is desperate if we pick at it. It is in the opinion of the Government on these lines, with this scope, and only with this scope, with the powers that are given in the Bill, that we can meet the situation. In inviting the House to pass the second reading of the Bill I venture to hope that in considering the grave situation hon. members will rise above the jealousy of road and railways, above the jealousy of the local vested interest—for, believe me, it is not only in the land that there is vested interest—and will subject local pride to the interests of the Commonwealth."

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ARRANGEMENT BETWEEN TRAMWAY OWNERS AND EMPLOYEES.

TERMS OF AGREEMENT—A 48-HOUR WEEK WITH PAYMENT AS FOR 54 HOURS.

The following terms of agreement were arrived at between representatives of the Municipal Tramways Conference, the Tramways and Light Railways Association, and the National Transport Workers' Federation, on Thursday, March 20, 1919, after negotiations extending over several months.

1. (a) That the working week shall consist of 48 hours inclusive of signing on and signing off.

(b) That with regard to the undertakings working 54 hours or more per week, the employees shall receive 54 hours' wages for 48 hours' work.

(c) That with regard to undertakings working more than 54 hours per week, the employees shall receive in respect of the reduced working week wages equal to those received for the number of hours at present worked up to a maximum of 57 hours.

(d) That a joint committee be appointed by the parties to this agreement to consider and determine special cases as outlined below:—

(1) Where it is claimed under Clause **1** (b) that a special consideration has already been given in respect of a reduced working week.

(2) Where it is claimed under Section **1** (b) and/or (c) that the normal working week is in excess of six days.

(3) Where a difference arises between the respective parties as to the exact number of hours worked per week.

(e) In so far as the Metropolitan area is concerned, 48 hours shall constitute the normal week's work without reduction in pay.

2. (a) That every employee shall be guaranteed a working week of 48 hours inclusive of signing on and signing off, or payment equivalent thereto, provided that such employee has presented himself for work at the appointed times on each of the six days, and, further, the employers shall be at liberty to utilise the services of any employee for whom work cannot be found upon the cars, upon such other work as may be considered desirable by the management, subject to such work not impinging on another man's job, and being only of a temporary character.

3. (a) That eight hours constitute a normal day's work, subject to local adjustment as agreed, or, at the request of the employees concerned, for working a shift of less or more than eight hours.

(b) Provided that if a duty exceeds nine working hours, inclusive of signing on and signing off, overtime to be paid from the expiration of eight hours, and if the day's duty is less than eight hours, but not less than seven hours, ordinary time to be paid for the time actually worked, but if less than seven hours, then the employee shall receive seven hours' pay.

4. That the question of spread-over time be left to each undertaking to confer thereon with the representatives of the trade union with a view to reducing the same to the lowest possible minimum, and the consideration of the same to be brought forward again for discussion not later than the 1st July next.

5. (a) That in respect of four National Holidays, viz., Easter Monday, Whit Monday, August Bank Holiday, and Boxing Day, time and a half rates shall be paid; but in regard to Scotland, four General Holidays shall be substituted for the above-named Bank Holidays, to be mutually arranged to meet local circumstances.

(b) In respect of Christmas Day (or in Scotland, New Year's Day) double time shall be paid in those undertakings where worked.

(c) That in respect of Good Friday, ordinary rates shall be paid, except in those cases where additional rates are paid which shall continue.

(d) That in respect of Sunday labour, time and a quarter rates shall be paid, but where additional rates are now paid, such higher rates shall continue.

(e) That overtime shall be paid at the rate of time and a quarter for the first two hours and time and a half for any additional work beyond in respect of each day exceeding nine hours, such overtime to be calculated from the termination of eight hours' work.

(f) That overtime rates shall be paid over a normal working week of 48 hours; where the general terms of daily duty have been nine hours or less, such overtime shall be accumulative and paid for on a weekly basis at time and a quarter for the first two hours and time and a half for any additional work beyond.

(g) Subject to the provisions outlined in Clause **2** (a) and Clauses **5** (e) and **5** (f), a margin of two hours shall be allowed to be averaged on each fortnight, viz., 46 hours minimum and 50 hours maximum in each of the two weeks without overtime rates being operative; but if the working hours per fortnight exceed 96 hours, an overtime rate of time and a half shall be paid, irrespective of whether overtime rates have been paid on the daily basis, on all time in excess of the said 96 hours.

NOTE. If the agreed margin be varied in any one week, viz., if 50 hours be exceeded then overtime rates shall commence from the expiration of 48 hours, as provided for in Clause 5 (f).

(h) In the event of an employee working voluntarily on his seventh or rest day, he shall be paid for such work at the rate of time and a quarter on the rate of pay prevailing that day.

6. (a) That six days' holiday with pay annually be granted after 12 months' continuous service, with an additional two days for the year 1920. In the meantime the question of holidays shall be referred to the Joint Industrial Council for decision.

(b) That this arrangement with regard to six days' holiday shall date from the present year.

(c) That the holiday period shall, as far as practicable and subject to local conditions, be granted between the 1st April and the 31st October in each year.

(d) That in calculating holidays for the purpose of payment, rest days shall not be included.

(e) That no employee shall be entitled to payment in lieu of holidays.

7. (a) That depot day staff employees shall be granted a working week of 47 hours at existing weekly wages.

(b) That depot night staff employees shall be granted a working week of 48 hours at existing weekly wages, such hours to include a meal time allowance of not less than 30 minutes each night.

(c) That the maximum number of hours to be paid for in respect of the reduced working week, referred to in **7** (a) and **7** (b) shall be 57, except with regard to the Metropolitan area, where the normal working week has been in excess hereof.

8. (a) That the terms of this agreement, so far as they affect the new rate of pay, payment for overtime, and extra work, shall operate as and from the commencement of the working week terminating prior to the first day in April, 1919.

(b) That the employers shall use their best endeavours to bring the whole scheme for a reduced working week into operation as soon as they can obtain the necessary labour to enable them to do so.

9. That the recommendations contained in the preceding paragraphs are subject to powers being granted by the proper authority to increase fares, now limited by statute or otherwise, before 30th June next, and that failing the granting of these powers by that date, this agreement shall be terminable on the receipt of one month's notice from either side.

10. That nothing in this agreement shall operate to the prejudice of any privileges or emoluments or conditions of service which an employee in an undertaking is now in receipt of.

11. Permanent way employees, whose services are of a temporary character, shall be excluded from the provisions of this agreement.

12. That in the event of any dispute arising between the parties hereafter as to the interpretation of any portion of this agreement, the same shall be referred to the Joint Industrial Council, or, pending the formation thereof, the joint committee referred to in Clause **1** (d) for settlement.

13. Provided that this agreement shall not apply to employees whose wages and conditions of labour are governed by other trade union agreements and awards.

RAILS FOR BIRMINGHAM TRAMWAYS.

According to the programme of reconstruction on the Birmingham Corporation Tramways, about twelve miles of single track are to be reconstructed. In their report the Tramways Committee said that it had been impossible to purchase rails in this country during the war. In February, 1919, an offer of rails was made by the Lorain Steel Company, who had previously supplied rails of a satisfactory quality to the City Council. An order was accordingly placed with the Lorain Steel Company for 1,000 tons. The committee advertised for tenders for a further 1,000 tons. Only three tenders were received, two from English firms and one from an American firm, the Lorain Steel Company. The latter firm, in addition to quoting the lowest price, offered full delivery April-May shipment, and their tender was in accordance with the usual specification. The next lowest tender contained the following statement:—"We are sorry we cannot undertake the delivery you stipulate—10 weeks; but we should probably be able to make delivery of about 50 tons a week, commencing in three or four weeks' time." The third firm, whose price was £2,000 higher than the lowest tender, could not deliver under twenty weeks. In the circumstances the Committee felt that they had no alternative but to place their order with the Lorain Steel Company.

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ELECTRIC WELDING AND ITS APPLICATIONS.*

By Walter Leonard Lorkin, A.M.I.E.E

Introduction.

Electric arc welding passed out of the experimental stage into the practical stage many years ago, but in spite of this fact, the subject is still rather vague to many people. It plays an important part to-day in the manufacture and repair of many articles. Some have hesitated to adopt the process, because they failed to see its advantages and doubted its efficiency. They did not appreciate that, by installing a small electric plant, they had at their disposal a ready means of carrying out work which had previously been beyond their power. They further, no doubt, thought that the plant and apparatus employed were complicated, and required extreme skill in handling, and probably thought that the amount of benefit gained would not be sufficient to justify the original outlay.

The object of this paper is to show to engineers and others that the process is simple, that it can be carried out with ordinary labour, and that the welds are efficient and effected at small cost. In miscellaneous shop repairs the cost of welding ranges from 1 to 10 per cent. of the value of the article repaired.

The pressure or resistance method of welding was invented by Elihu Thompson, and commercially produced about 1880. Resistance, pressure, or contact butt welding is an operation where two pieces of metal are brought to the plastic state by passing a heavy current of electricity across an imperfect contact, when, by means of pressure, the weld is effected. The parts are placed in position so that, the welding temperature being reached, consequent increased pressure establishes their union; the weld is generally hammered during cooling. The system is commercially successful, and has been largely used in the production of many parts for years past. In order to obtain the large amount of current which is required effectively to weld even small pieces, it is usual to employ an alternating current transformer. This is incorporated in a special machine, which consists of a clamping device, by which the heated surfaces may be brought together directly they are raised to the correct welding temperature. The transformer is of the ordinary double-wound type, having a primary winding suitable for the supply voltage and periodicity of the circuit, whilst the secondary is a single turn, and is usually in the form of a large copper or bronze casting. The current produced in the latter has, generally, only a pressure of a few volts, whilst the current may be many thousands of amperes. As this high current cannot be conveniently carried for any distance, it is usual to form a clamp for holding the work directly upon the ends of the secondary winding, so that the circuit may be as short as possible. To deal with the many shapes of commercial parts, the welding apparatus must consequently be designed for the various demands.

One of the most popular of these designs is employed in the joining of bars end to end. The clamps are fitted upon the bars about 3 in. away from where the union has to be effected; the hand lever is then applied, thus bringing into contact the two surfaces to be joined. The current is then switched on to the primary of the transformer, and the heat consequently generated at the contact softens the metal. Further pressure, applied by means of the hand lever, causes the two surfaces effectively to weld together, and to form a bulge round the joint. The current is then switched off, and the work removed. In the larger sizes of these machines the pressure is applied by hydraulic means, and the electrodes, or clamp ends, are often water-cooled, to prevent their heating up through continuous use.

Electric Spot Welding.

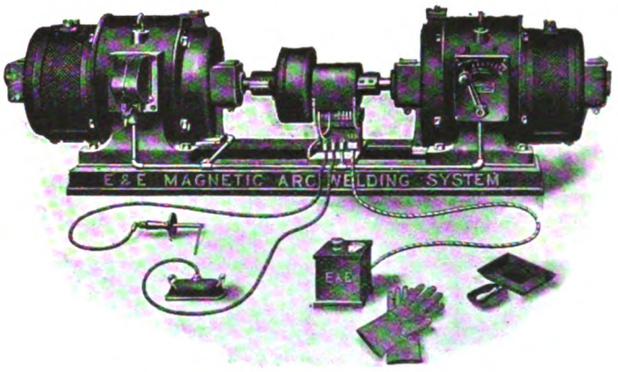
A development of this process is known as spot welding, and its particular application is for the joining of thin metal sheets, wires, or plates together, by means of a series of spot welds, thus replacing riveting. The operator places the metal sheets upon the table over the lower or stationary electrode so that the overlap or joint occurs in the correct position. He then brings the upper electrode down upon the work at the spot where the weld is required. Heat is at once generated, and the two plates are pressed together by means of the upper electrode. The pressure is then released and the sheets moved into the position for the next spot weld. Under this system it is possible to produce as many as six or eight spot welds per minute, according to the thickness of the plates and the character of the work. The system has also been applied to the welding of rail ends. The machine for this work is shaped like a large inverted U, carried above the rails by means of a crane.

Requirements of the Arc.

It is well known that an arc is formed by touching two contacts or poles of an electrical supply circuit, and withdrawing them slightly. An arc is thus established which, in burning, consumes the electrodes. The temperature of an electric arc is the highest known, exceeding 3650 deg. C. The positive pole is about 1000 deg. in excess of the negative. At the moment of striking the arc a virtual so-called short circuit is formed, which permits a rush of current far exceeding that afterwards consumed in the arc. This high-value current would, uncontrolled, produce evil effects, such as the melting of fuses and the opening of circuit breakers, besides imposing great strain upon the generating plant. Therefore it is necessary to introduce some means which will prevent this, or at all events limit it to reasonable values. This can be carried out by various methods. The best-known and perhaps most widely-used method is to insert in the circuit an amount of resistance which will only allow the current to rise to a safe value on striking the arc. Unfortunately, the resistance has to remain in the circuit the whole of the time the arc is working, and wastes a considerable amount of energy by converting it into useless heat. The amount of resistance is governed by a law relating to the permissible rise of current at the arc. Fifty per cent. is about the highest value which can safely be used, and this entails that approximately the same amount of energy should be consumed in the resistance as in the arc. As the arc voltage is about 25, the supply should have sufficient pressure to equal this and that consumed in the resistance. With the 50 per cent. rise named, 25 volts must be the pressure across the resistance, so that the supply pressure will not be less than 50. Where higher voltages are used (and there are many cases in actual working), the loss in the resistance, or stabiliser, as it is often called, is even greater, and may be twice and even three times that consumed in the arc. The author has found many cases where 110 volts are used, and in several instances 200 and even 210 volts. As only 25 volts are used in the arc, it is apparent that the remainder are absorbed in the huge resistance and dissipated as useless heat. Obviously, if we are to work economically, we should employ the lowest line voltage at which we can carry out efficient work. This loss or inefficiency in arc welding, is a serious feature, but it can be obviated in various ways.

The Voltage of the Welding Arc.

The voltage between a ferrous metal electrode and the iron or steel operated upon will be found generally to vary from 18 to 25 volts. The variation is due to the operators, who hold different lengths of arc, according to their individual method of working. Twenty-five volts is the most common figure, although many of the best workers prefer to retain the arc at 23. To draw an arc over 27 volts results in bad work; flaming occurs, and there is the liability of bubbling in the molten metal.



Motor Generator Arranged for Welding.

The lowest voltage at which the arc can be maintained for any length of time is about 18, but its employment depends upon the character of the metal forming the electrode and the flux, as a softer metal or ferrous alloy will vaporise at lower temperatures, and furnish conductive gases, thus allowing the arc to be established at lower voltages.

In the alternating current arc the author has found the voltage across the arc to be slightly higher. This is probably due to the fact that it is impossible to hold a short arc, owing to the peculiar way in which the metal falls in globules from the electrode. The voltage, therefore, with alternating current is about 30 volts, although it is continually fluctuating as the globules form and fall. It is well-known, however, as shown by the investigations of the late W. E. Duddell and others, that the electrical arc, by its rapid variations of resistances, produces oscillation effects at a very high frequency.

Carbon Arc Welding.

Electric welding, using the carbon arc, is the older of the two main systems in autogeneous welding, and was originated by Benardos over 30 years ago. In this system, graphite carbon electrodes are used, and they vary from ¼ in. to 1½ in. in diameter, and from 6 in. to 12 in. or more in length. They are pointed so as to focus the work as much as possible. The sizes vary according to the class of work to be done. The carbon is mounted in a suitable holder, and it is

* Abridgement of a Paper read before the Royal Society of Arts on March 12, 1919.

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attached to the negative pole of the supply, the positive being attached to the work. It is very important to observe that this polarity is maintained correctly, as if it is reversed molecules of carbon will be conveyed from the electrode to the work and incorporated in the newly-deposited metal, rendering it very brittle and difficult to machine subsequently.

The process of carbon arc welding is employed for the filling of holes in castings and in the cutting of metals. The carbon arc in such cases supplies the heat, the filling metal being provided by a metal bar fed into the arc. Fig. 1 shows an operator at work with this process. With the carbon arc it is necessary to have 45 volts or more, and from 100 to upwards of 600 amperes, the variation

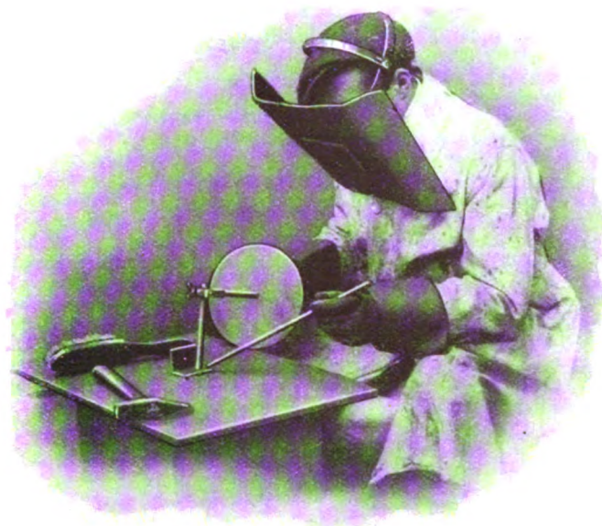

Fig. 1.—Welder at Work.

being decided by the class of work and speed at which the operation is to be conducted.

Carbon arc welding has its own particular sphere. It is especially suitable for rectifying steel or malleable iron castings rendered defective through the presence of blowholes and other imperfections. It has also the power of washing out sand from internal hollows and replacing it with new metal, applied from a wrought-iron bar in the other hand of the operator. When skilfully done, these blowholes can be so filled up that no trace remains. The value of carbon arc welding in the foundry is thus evident; an imperfect casting is no longer food for the scrap-heap, but is an object to be perfected. Another advantage is that holes can be quickly produced in iron or steel plate by holding the arc over the spot until the metal melts

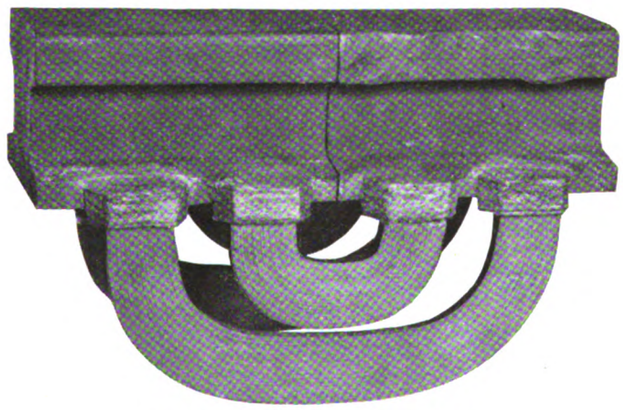

Fig. 2.—Bonded Conductor Rail.

right through. Thus it forms a quick and cheap substitute for rough drilling.

The repair of holes worn oval in machinery is another sphere for the employment of the carbon arc. For example, take a tramcar part, with such a hole. In the centre, the oval hole is filled in with new metal, and at the side a hole is redrilled to the correct size. Thus, by this means many parts which would otherwise have to be scrapped can be reclaimed and used again. In the tramway and railway world there is much work of this character to be done, and here the importance of electric arc welding cannot be over-estimated. Fig. 3 shows an operator effecting repairs to a tramway rail joint.

Electric Bonding of Rail Joints.

Another field for the use of the carbon arc is in copper bonding of rails for electric traction purposes. The welding of bonds across rail joints is an American feature. Fig. 2 shows a copper bond, of large section, fitted to a conductor rail of an electric railway system. The bond itself consists of laminated copper strips. The carbon arc, directed upon the ends of the copper strips, melts them down, and welds the copper bond to the steel rail. Further supplies of copper can be fed in from a copper melt bar, held in the left hand of the operator. By this process, the molten copper is burnt into the edge of the rail. The same process is then repeated at the other end of the bond, thus forming a solid copper weld at the edge of the rail.

There is an enormous advantage in this system of bonding. The ordinary method of attaching bonds entails drilling holes in the rail and fitting the ends of the bonds with taper pins, driven in from the other side. Bonds thus fixed are liable to work loose under traffic conditions, the connection is consequently imperfect, and a dangerous fault in the system arises. With the electrically-welded bond this danger is entirely absent, as perfect electrical connection is made, and the necessity of drilling holes is avoided. Not only is there a great saving in labour by this process, but there is also the saving of energy otherwise lost in defective rail circuits.

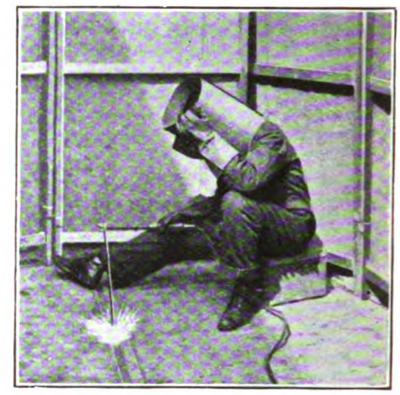

Fig. 3.—Operator Repairing Tramway Rail.

Cutting Metals by the Carbon Arc Process.

The carbon arc process is also largely used for the cutting of metals; but the work performed is not as neat as that done with an oxy-acetylene blowpipe. This is due to the fact that the arc oscillates from one side to the other, thus melting the adjoining edges of the metal. The actual cutting is accomplished more quickly with the electric arc when dealing with metal up to 1¼ in. in thickness. Its value in cutting up scrap metal and in demolition work is thus evident.

Metallic Electrodes.

Metallic electrodes are a comparatively recent introduction in electric arc welding, and apparently were originated by Slavinoff in the year 1895. Here the necessary filling metal is supplied by the metallic electrodes themselves as they melt, and this simplification of the process of welding indexes an important advance. This stage, however, was not final. The rapid cooling of the metal from the electrodes, coupled with a considerable amount of oxidisation, tends to make the deposit brittle and spongy. This immediately suggested that some form of flux was necessary to assist the process of fusion. Kjellberg, about 1897, introduced a flux for metallic electrodes, and later Mr. Strominger, of London, developed an elec-

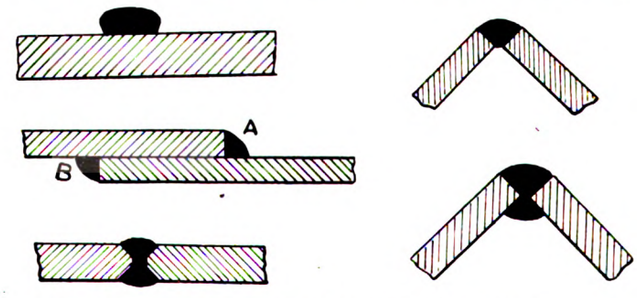

Fig. 4.—Typical Examples of Welded Joints.

trode already fluxed. Various fluxes have, from time to time, been developed and can be applied either by laying them upon the work during the process of welding, or coating the electrode itself with the flux material. The latter has found preference, mainly because the right amount of flux is conveyed to the arc as the welding proceeds. These fluxes generally consist of silicates, the fusing point of which is high and which, as heat-resisting agents, furnish a desirable coating over the newly-deposited metal.

Coated electrodes have now become a commercial article with a competitive market. They are sold in bundles, ready for use, in various gauges.

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Electric welding is very similar to oxy-acetylene welding, in that a V groove is formed at the joint, into which the metal is deposited. In Fig. 4 is shown a plain butt joint, V'd both sides, with the metal deposited, the black portions showing the latter. It will be noticed that there is a resulting increased thickness of the plate where the weld occurs. This is considered a permissible feature in welding and enables the original strength of the plate to be maintained. By piling up the metal in the manner shown, the strength of the weld can be made greater than that of the plate itself. To the right is an angle joint constructed in a similar manner. It will be seen that the plates automatically form a V groove of 90 deg., without any special preparation, suitable for depositing metal into. It is essential that the edges of the plates, before welding, do not meet,

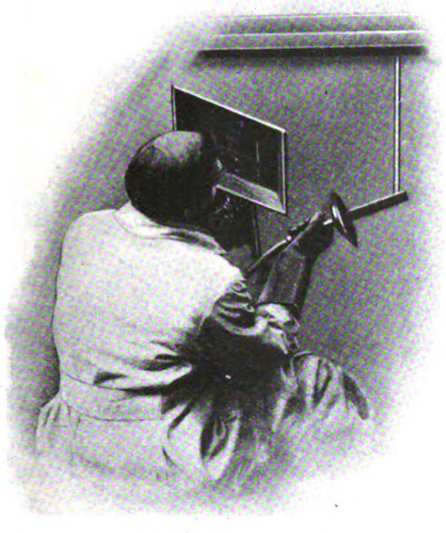

Fig. 5.—Overhead Welding.

otherwise the newly-deposited metal will not pass through to the other side. The centre left-hand sketch in Fig. 4 is a lap-joint welded at both the upper and lower edges of the seam. This joint is commonly used in ship construction, and has the advantage that it caulks the joint automatically at the same time. These three joints are typical of the great majority of work carried out, but many other types will, no doubt, be suggested. Another feature of the metallic electrode is that it is possible to weld vertical and even overhead seams. Both these processes, however, are slower, and require more skill than downward welding.

Welding a vertical seam is more difficult than downward welding, and the process is slower. The operation is started at the bottom of the seam, and the metal gradually built up. The deposited

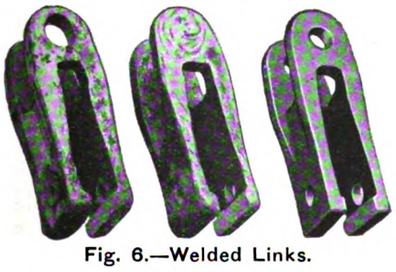

Fig. 6.—Welded Links.

metal is frequently hammered to consolidate it and give a better appearance.

Fig. 5 shows the operation of overhead welding. This is the most difficult of all positions, and needs expert skill. The making of vertical and overhead welds is largely a matter of experience, and an expert operator will so play his arc that the metal has time partly to set. It is impossible in overhead welding to do so neat work as when the welding is downward. Considerable hammering and caulking is necessary to consolidate the metal and to remove the globules which remain, due to the action of gravity, when the metal is in a semi-molten state. It is, however, quite possible to make satisfactory overhead welds (a number of examples of which, together with others, were exhibited by the author).

Alternating Current.

The facilities which exist for the transmission and transformation of alternating current would imply that this current is particularly suitable for welding work. The fact that the current can be conducted to the location of welding operations by small wires conveying current at high voltage, and there converted by means of static transformers to a pressure suitable for the welding arc, indicates the great advantage to be derived. A disadvantage, however, is found in the arc itself, which is not so stable at low voltage, and cannot be so easily handled as the direct current arc. Further, alternating current is not so efficient as direct current. The voltage between the electrode and the work is nearer 30 than 25, and it is necessary to have a considerable reserve of voltage in the supply circuit to maintain the arc.

Types of Supply and Generating Plant.

Electric current for welding can be drawn from any suitable supply, providing it is ample to meet the demands, and is of the correct voltage. Very few public supply undertakings will permit current to be drawn from their mains for direct use in an arc for welding purposes. As the current is usually 100 amperes and upwards, the sudden demand of the welder would submit a strain upon any system to the detriment of other neighbouring consumers. Another drawback is that practical welding work often requires one pole to be earthed, and as large masses of work (boilers, for instance) cannot be effectively insulated from the ground, such earthing would not be allowed by the supply company. When, however, a transformer or motor generator is imposed between the supply and the arc an amount of flexibility which eradicates or smooths out the erratic demands of the welder is thus secured which removes the trouble due to earthing. Further, few supply companies furnish current at a voltage lower than 200. This would entail great loss in the current-limiting resistance or stabiliser above referred to. Current, however, can be taken from the consumer's own generator, which should be wound to give a voltage of 60, to enable the arc to be efficiently supplied. Such machines can be made to feed any number of welding arcs in parallel, and may be driven by any form of steam or internal combustion engine. The engine, however, of whatever type, should have sufficient fly-wheel effect, and should be fitted with a sensitive governor.

The welding generator should be evenly compounded. The welding load is, perhaps, the worst form of load which the generating engineer has to cope with. It is worse, in fact, than many traction loads, and the plant, therefore, must be constructed of such a type as will meet these extraordinary demands. An ordinary dynamo of the type to meet a lighting load would be quite unsuitable for welding purposes, owing to the fact that it is not designed to withstand the enormous strains imposed upon it. A shunt-wound dynamo is obviously unsuitable, owing to the severe dropping characteristic, and the nature of demand, for, upon striking the arc, there is obviously a heavy rush of current, which brings the voltage to a very low point, from which it has to be built up again

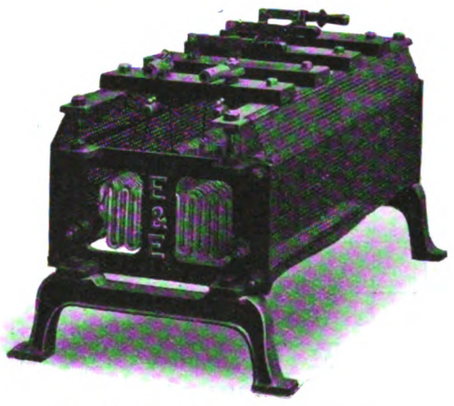

Fig. 7.—Taper Type Resistance.

for the welding current. Where such a machine has already been put down erroneously for welding work, the fitting of a separate exciter will, to a large extent, establish its suitability.

Motor-driven Generators.

Where the electric supply has to be transformed for direct current welding work, the converting apparatus may be classified as follows: Taper or parallel path resistance, rotary converters, double-wound armature machines, plain motor generators with fixed couplings, motor generators, reducer balancer sets, motor generators, with magnetic automatic slipping clutches. The majority of these are so well known that the author only proposes to describe in detail the last-named.

Where the voltage of the circuit is consistent at 60 or 110 volts, a resistance is necessary to limit the current in the manner above described. Usually there are two types of resistances or stabilisers in use. One is the taper type of resistance shown in Fig. 7.

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Motor Generators with Magnetic Automatic Slipping Clutches.

This is a recent development of a motor generator, having an automatic slipping clutch, or magnetic coupling, which is differentially wound. This clutch is the invention of Messrs. W. I. Davies and A. Soames, and is called the "Daysohms." The great advantage of this clutch is that the use of the current limiting resistance is entirely avoided.

Fig. 8 shows a section of the clutch. The motor, or driving end, is on the right, and carries the body of the clutch. This is really a rotating pot form of magnet, having the poles at point M. G is the yoke which is supported on a driving plate mounted on a radial

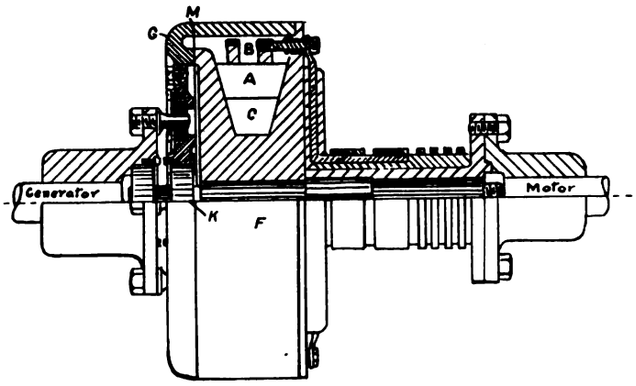

Fig. 8.—Section of Daysohms Slipping Clutch.

ball-bearing K. The dynamo shaft on the left carries a coupling, with pins, engaging in bushed holes in the driving plate, and also another ball-bearing to support the weight of the body F. The energising coils are situated at A, B, and C. A is the main magnetising coil of fine wire, energised from some convenient constant potential source, such as the motor-driving supply, and magnetising the clutch in a direction which we will call positive. B is a few turns of heavy copper strip, carrying the whole of the welding current, and magnetising in the opposite direction to A, or negative. C is another fine wire coil which is connected as a shunt across the dynamo terminals. This is also connected in a negative sense, so that B and C tend to operate against, or weaken the flux due to A. Upon

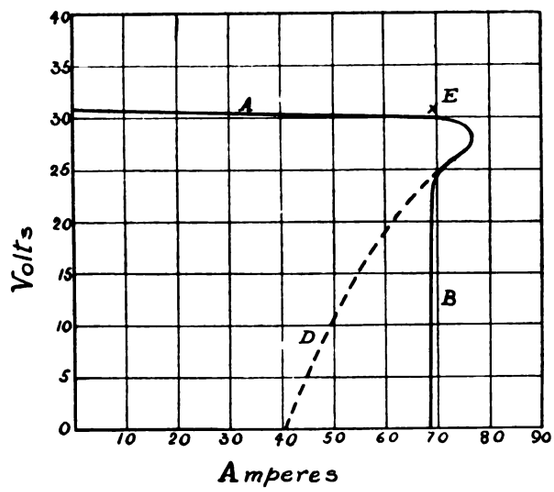

Fig. 9.—Characteristic Curve of Machine Fitted with Slipping Clutch.

starting the machine, coil A is energised so that the clutch revolves as a solid piece, and with the dynamo exciting (it is separately excited from the motor supply) coil C comes into operation, weakening the clutch hold to a certain degree. Upon striking the arc, current flows through coil B, and if the current exceeds a certain amount, the combined effort of B and C will neutralise the flux due to A, and the clutch will slip.

Fig. 9 shows the characteristic curve of a machine bearing this device. It will be seen that the current here rises to 70 amperes, at which the clutch is set slip. Owing to the peculiar behaviour of the law governing the co-efficient of friction, the clutch would hold on too long, and on slipping the power would fall right off, the current descending down the dotted line D. It is here that the advantage of coil C is evident, for, as the dynamo speed falls, due to the slip, its volts descend, and the effect of coil C in its demagnetising properties becomes less. This is equivalent to strengthening the flux due to A and allowing the clutch to regain its hold, so that the current falls down the vertical line C. E is the point of operation, so that no slip occurs, except upon the operator shortening his arc, or otherwise raising the current. The nose seen in the curve is of great advantage in working, as it enables the operator to strike the arc with ease. By means of small rheostats, the currents in coils A and C and their consequent magnetic effects can be varied, thus giving the operator a considerable range in current values.

The whole of the apparatus and accessories used by the author were manufactured at the works of the Equipment and Engineering Company, and the examples of welds were made by their own operators. The specimens of spot welding, however, were lent by Messrs. The Electric Welding Company, Limited, and Messrs. The A.I. Manufacturing Company. The author has also to thank Messrs. Davies and Soames for permission to include a description of the "Daysohms" clutch, which is incorporated in the "magnetic arc welding system" as made by the Equipment and Engineering Company.

LONDON TRACK AND CAR DEFECTS.

Effects of the Shortage of Materials.

That a long time must elapse before tramway services can be restored to the pre-war standard is shown by reports recently presented by the Highways Committee of the London County Council. At the authority's meeting on March 25, it was reported that owing to the shortage of repairing materials the number of cars in service was 86 short of the requirements. As regards the car shortage, good progress appears to have been made, judging by the Highways Committee's report, presented at the meeting of the Council on March 4. The Committee therein explained that the present time-table requires 1,244 electric cars (amounting with 20 per cent. spares to 1,493 cars), and 114 trailers (amounting with 5 per cent. spares to 120 cars). On February 20, 1919, only 1,049 electric cars and 114 trailers were in service; there being therefore 195 electric cars short of immediate needs. The total numbers of cars held by the Council are 1,662 electric cars and 158 trailers, so that the electric cars out of service for repairs exceed 600—approximately 40 per cent. of the total number.

The shortage from present time-table requirements has developed during the past few weeks, as a result principally of an unexpectedly large number of breakages of axles. During 1914—when the average number of cars in service was larger than now—only 127 axles broke. During the short period from January 1 to February 12, 1919, the number of axle breakages was 288. The rate was particularly high during the recent frosty weather, and the high average during this period is attributed partly to the overloading of cars under present conditions at times of heaviest traffic, and partly to the depreciated condition of the rolling stock, as a result of the heavy use to which it has been subjected over nearly five years—in which period abnormal conditions caused by the war have made it impossible to maintain the former high standard in connection with car repairs and renewals. Every effort is being made to overcome the present car shortage.

During the war many cars have had to be depleted of available parts unobtainable from outside sources to replace broken or worn-out parts on service cars. The manufacture—practically discontinued during the war, except for munition purposes—of malleable iron and steel castings and forgings is being resumed, but, as all undertakings are pressing for the same materials, delivery is slow. Stores and equipment of all kinds, required for maintaining cars in serviceable condition, continue in short supply. The time within which it will be possible to meet the present time-table requirements depends on the rate at which supplies of these commodities are obtainable.

The general manager had advised the committee that unless he had greater facilities for obtaining supplies he saw no prospect of making a greater number of cars available. Opportunities of obtaining supplies are frequently lost owing to the unwillingness of contractors to quote except for immediate acceptance. The Highways Committee decided to make temporary arrangements in order to facilitate the acquisition of stores and materials up to October 31, when they will again review the whole position. Under the temporary arrangements, which were agreed to by the Council, the general manager is authorised to open tenders where the estimated expenditure is £500 or less, and to accept any such tender or quotation provided that his action be reported to the committee in a form showing separately (1) tenders or quotations resulting from competition, (2) quotations invited from one firm only in each case, (3) unsuccessful invitations of tenders or quotations, and (4) orders placed on emergency without tenders or quotations having been invited.

Replying, at the Council's meeting on March 25, to criticisms at a Newington inquest on the condition of the tramway track, Mr. Hume, chairman of the Highways Committee, stated that the Council were not responsible. The Highways Committee had frequently reported on the impossibility of obtaining either the rails, the road material, or the labour required to put the track in proper condition.

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DIFFICULTIES OF TRAMWAY OPERATION DURING THE WAR.

A Memorandum by Mr. J. B. Hamilton,
General Manager, Leeds City Tramways.

The following is a memorandum presented by Mr. J. B. Hamilton, general manager of Leeds Tramways, to Leeds Corporation Tramways Committee, setting forth the chief difficulties in providing adequate service during the war and under post-war conditions. The memorandum was compiled for the information of the tramways committee and was subsequently published at their desire in the local press, in order that the travelling public might understand how serious have been the difficulties encountered. We give the document in full, as it deals with conditions that have prevailed generally throughout the country :—

The difficulties affecting city transport in all parts of the country have been gradually increasing, but it is now hoped that they have reached the climax. In every undertaking in the United Kingdom, but more particularly in those which serve big industrial populations, the same factors have been met. These are the large number of men employed as motormen and conductors whose physique has been found acceptable to the medical authorities of the army, and, secondly, the enormously increased demand upon the carrying capacities on the various routes. For some months past the inhabitants of all the large towns have been very much inconvenienced by the paucity of service. Many criticisms by irate would-be passengers have been passed upon those in control of undertakings, and no doubt the inconvenience existed, but the causes which produce it have been absolutely beyond control. Statements have been issued by the tramways committee in many towns, such as Manchester, Sheffield, etc., explanatory of the deficiencies of the service, and it is for the same reason that the following brief summary of facts relating to the City of Leeds is now set forth :—

Beginning with the recruiting of the staff of motormen and conductors, these numbered 1,112 at the commencement of the war. Of this number 772 have gone on active service during the war. The total number in the service in January, 1919, was 956, of whom 396 were female conductors. It will be observed that whilst the personnel must be to a large extent new, that a reduction in the total number of 156 has occurred in spite of every effort to keep up the numbers. The provision of a service of vehicles on tramways differs entirely from the carrying out of work in a factory where any duty not completed can be taken over for the next day. It is necessary, therefore, as the service must be maintained, to have, if at all possible, a considerable number of spare employees who can take up duties should the regular employees be absent. The extraordinary severity of the weather and the presence of a virulent form of influenza, and no doubt other causes, resulted in an increase from 1914, when there were 45 people absent from sickness, to the same period of 1919, when there was an average of 193 absent. The number, of course, fluctuates from day to day, and as a matter of fact on some mornings over 200 employees were unable to turn out to their duties on account of sickness.

The great scarcity of materials and labour caused the maintenance of cars to be very much delayed and probably not so completely executed as under normal conditions. The considerable overloading and the large number of less experienced drivers has further accentuated this. In January, 1914, an average service of 220 cars per day was given. In January, 1919, this had fallen to 206. The number of journeys missed, however, is very much greater. In January, 1914, the number was four ; in January, 1919, this had risen to 70.

The comparison of passengers carried with the decreased number of cars shows that in January, 1914, a total of 7⅞ millions were carried. With an average of 14 less cars per day, a total of 9¾ millions were carried in 1919, a *pro rata* increase per car of 37 per cent.

The two unusually severe snowstorms which visited the district in December and January last have created a tremendous amount of extra work in the repair of cars. In weather of that character the water and snow is splashed into the electrical parts and creates short circuits. Not only is the number of cars rendered *hors de combat* doubled, but the damages due to this class of weather, being principally in the electrical portion, require a very considerable amount of repair. At the present time the repairs to the armature portion of the motors is far behind the requirements, notwithstanding that repairs have been carried out by the staff in the depots and in several parts of the country wherever it is possible to get makers to take up the work. The extraordinary increase in this section of the work is shown by the following figures :—In 1914 67 armatures required re-winding ; in 1918 this had increased to 217, or an increase of 224 per cent. As compared with 1914, the total number of cars which for reasons of scarcity of material or labour are unable to be repaired and put into service has increased by 20 per cent. Although application has been made in many directions for demobilisation of pivotal men required for constructing and repairing cars and permanent way, a very small number has yet been returned. The principal reasons for the large number of cars being laid up in the depots are as follows : —

Armatures.—This is one of the most serious troubles in motor defects, chiefly due to faulty driving, bad track, and overloading, and has been such that our present staff of armature winders has been unable to cope with the work. We have therefore been compelled to get a large percentage of armature repairs done by private firms whenever possible. Unfortunately, the delivery of armatures from these firms has been uncertain, and at the present time a large number of cars are still disabled on this account. Forty-four armatures are at present away at five different firms for re-winding, and every effort is being made to get this work completed quickly.

Gears and Gear Cases.—A large number of cars are now running without gear cases, as we have not been able to get delivery of these during the period of the war, and, as the wear on gears and pinions without lubrication is very rapid, the number of cars coming in for gear wheel renewals is increasing daily.

Life-guards.—The increased number of life-guard breakages is due solely to the bad condition of the track, and the necessary repairs to these have been delayed by the non-delivery of materials. After a heavy snowstorm many life-guards are always broken, and under present conditions there are no spare cars available to maintain the re juired service.

Trolleys.—The abnormal number of trolley troubles is chiefly due to the bad track, faulty driving, high speeds over bad track through frogs, crossings, and round curves.

Controllers.—The conditions obtaining with regard to these are inefficiency in operation and repair.

Hand Brakes.—The general condition of the brake gear is due to failure of supplies of bolts, nuts, pins, etc.

Track Brakes.—These have suffered severly owing to the bad condition of the track. In many cases the repairs to the damaged gear necessitates the car being in the repair shop for two or three days.

Accidents —Damages to cars by collision in 1918 have increased to the alarming extent of 370 per cent. over the corresponding period of 1914, due to inexperienced drivers.

Power and Light Cables.—The frequent breakdown of light and power cables is chiefly due to the fact that most of the cars require re-wiring throughout, as with their length of service the insulation has perished, with the result that in the particularly inclement weather which is experienced at this season of the year breakdowns are unavoidable. The present position with regard to staff and materials renders re-wiring impossible.

Destination Indicators.—These have suffered severely by the rough treatment of the conductors, lids being left off, thus allowing the linen, wiring, lamp holders, etc., to become saturated with water, with the result that we have been unable to cope with the necessary repairs.

Railless Cars.—It has been impossible to maintain a regular service of these cars at Guiseley owing to not being able to get materials for repairs, viz., armatures, worm gear cases, rear road wheels, etc.

It is gratifying to find that very considerable numbers of the men who were in the service in 1914 and have since been on active service are now returning and taking up their duties again. They will undoubtedly give stability and regularity to the service, and already an improvement is recognisable. In the meantime every effort is being made to get more cars on the road, and it is hoped within a short period that 30 additional cars will be available for daily service, but it will be many months before the system can be built up to the high standard of maintenance and comfort which in the past were its distinguishing features

Comparison of Repairs.—Leeds City Tramways.

January 1914 and January 1919.

Total number of defective cars run into depot, January 1 to 31 inclusive, 1914—331.

Total number of defective cars run into depot, January 1 to 31 inclusive, 1919—768.

The chief defects coming under the following headings :—

	1914. 31 days.	1919. 31 days.		1914. 31 days.	1919. 31 days.
Life-guards	8	138	Cables—Power	14	17
Trolleys	16	69	Light	4	25
Collisions	3	17	Handrails alive	3	6
Brakes—Hand	14	78	Hot axles	11	17
Electric	4	3	Broken axles	5	2
Track	16	64	Tires	3	9
Motors	170	199	Broken windows	12	7
Controllers	21	70	Miscellaneous	23	33
Resistances	4	14	Total	331	768

The total number of armature repairs for the year 1914 was 728, of which 67 had to be re-wound.

The total number of armature repairs for the year 1918 was 772, of which 217 had to be re-wound ; 85 by outside contract.

Total number of defective cars run into depot during seven days, weather normal = 70 ; immediately after snowstorm = 164.

Total number of cars run into depot for defective life-guards during seven days, weather normal = 13 ; immediately after snowstorm = 53.

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THE LONDON COUNTY COUNCIL TRAMWAYS.

Annual Accounts, 1917–18.

The Highways Committee at the meeting of the Council on April 1 submitted the following statement on the annual accounts for the year 1917–18:—

The accounts of income and expenditure for the year ended March 31, 1918, have now been made up, and the Highways Committee submit the accounts as prepared by the comptroller of the Council, together with a memorandum by the general manager on the working of the undertaking.

The tramways system on March 31, 1918, extended over a total length of 149 street miles, being 144½ miles of electric lines (122 conduit and 22½ overhead), and 4·6 miles of horse lines. The whole of the system is worked by the Council, with the exception of 2½ miles (partly double and partly single line) in Harrow Road, which is worked by the Metropolitan Electric Tramways, Limited, on the overhead system of electric traction. The undertaking comprises the lines transferred to the Council from various tramway companies, together with new lines constructed by the Council.

The only horse tramway routes not yet electrified are those in Burdett Road and Grove Road, etc., and in Southwark Park Road, etc., and as the services on these tramways have been withdrawn the system in operation by the Council consists entirely of electric tramways, the length being 141·67 street miles.

Results of Working.

The total income from the undertaking during the year and the working expenses were as follows:—

Year ended March 31.	1918.	1917.	1916.	1915.	1914.
	£	£	£	£	£
Income	2,932,140	2,552,203	2,339,291	2,399,487	2,268,669
Working expenses* ...	2,128,686	1,817,694	1,683,660	1,700,212	1,615,467
Surplus on working ...	803,454	734,509	655,631	699,275	653,202
Deductions —					
Debt charges —					
Interest ...	293,568	314,164	326,477	330,300	—
Redemption ...	428,320	429,851	425,908	405,605	—
	721,888	744,015	752,385	735,905	736,602
Rent drawbacks, etc.	—	7,551	6,797	—	—
Income-tax	75,412	73,000	40,000	32,102	28,197
Parliamentary expenses	—	18	2,260	2,803	2,082
Amount due to Metropolitan Electric Tramways, Ltd., under through-running agreements	—	1,528	—	—	—
Other charges ...	249	—	—	—	—
	797,549	826,112	801,442	770,811	766,881
Less tax deducted, interest on cash balances, rents, etc. ...	89,654	102,945	72,061	38,363	25,153
Total deductions from surplus	707,895	723,167	729,426	732,448	741,728
Balance	95,559 (Surplus)	11,342 (Surplus)	73,795 (Deficiency)	33,173 (Deficiency)	88,526 (Deficiency)

* Includes war service allowances, 1917-18, £119,432; 1916-17, £110,155; 1915-16, £95,365; 1914-15, £42,209.

The total number of passengers carried during the year was 593,516,141; the number of car miles run was 49,189,866. The corresponding figures for 1916–17 were 586,127,976 and 49,478,973.

The operating expenses were £2,002,200 (excluding war service allowances of £119,432 4s. 7d., and certain special charges amounting to £7,053 1s. 5d.).

In the following table particulars are submitted, as regards electric tramways worked by the Council, of the average track miles open, receipts per mile of track, the total number of passengers carried, and the gross passenger receipts for the 12 years ended March 31 1918:—

Year ended March 31.	Average electric track miles open.	Average passenger receipts per track mile.	Total number of passengers carried on electric lines.	Gross passenger traffic receipts.
		£		£
1907	40·66	19,929	183,062,063	810,320
1908	61·91	20,223	279,166,461	1,252,001
1909	77·94	19,752	344,705,937	1,539,434
1910	99·61	18,546	418 317,377	1,847,327
1911	116·98	17,925	482,296,935	2,096,914
1912	127·55	17,498	516,092,489	2,231,902
1913	132·49	16,179	501,102,149	2,143,559
1914	136·62	15,967	516,338,859	2,181,344
1915	140·66	16,516	547,253,332	2,323,130
1916	141·52	16,097	545,247,747	2,278,115
1917	141·67	17,479	586,127,976	2,476,309
1918	141·67	20,206	593,516,141	2,862,554

Capital Expenditure and Repayment.

The capital expenditure on the undertaking up to March 31, 1918, amounted to £13,059,588 19s. 4d., of which £89,469 17s. 5d. represents expenditure during the year 1917–18.

The amount of the debt incurred up to March 31, 1918, was £13,988,671 19s. 4d. The net debt on March 31, 1918, i.e., the debt outstanding, after allowing for debt repaid out of revenue and sinking fund balances, and for £120,216 in respect of the value of surplus land, was £8,764,004 8s.

The sums paid by the Council out of the revenues of the tramways undertaking during the past six years for the redemption of debt have been as follows:—

1912–13, £388,042	1915–16, £425,908
1913–14, £408,488	1916–17, £429,851
1914–15, £405,605	1917–18, £428,320

The total amount of debt repaid out of revenue up to March 31, 1918, was £4,613,919, to which must be added an amount of £401,870 from proceeds of sales, making in all £5,015,789.

The amount of capital expenditure, which up to March 31, 1918, had become obsolete owing to the electrification of horse tramways, was £2,024,687 15s. 3d. The debt in respect of this expenditure has been reduced to £914,896 2s. 9d. Certain other expenditure amounting to £117,829 15s. 4d., incurred in connection with electric traction, has also been rendered obsolete. The repayment of this is being provided for over short terms specially approved by H.M. Treasury.

Renewals Fund and General Reserve Fund.

The renewals fund amounted on March 31, 1818, to £324,451 5s. 11d. Up to the year 1911–12 full provision for this fund was made out of the revenues of the undertaking on the basis approved on June 23, 1908, of two-thirds of a penny for each car-mile run, but the financial results of the working of the past six years have not enabled provision to be made on this basis. During this period the available surpluses have been paid into the fund, including in 1917–18 the surplus of £95,559 3s. 10d. The consideration of the basis of the provision has been postponed from time to time.

The general reserve fund on March 31, 1918, amounted to £74,667 4s. 6d. In the case of both the renewals fund and the general reserve fund the balances stated take no account of the depreciation of investments.

War Service Allowances, War Wages, and War Bonus.

The total of the war service allowances granted by the Council and charged to the tramway's account during 1917–18 in respect of men serving with the forces of the Crown amounted to £119,432. From the outbreak of war until March 31, 1918, the tramway's account has been charged with a total amount of £367,162 for war service allowances.

The cost of the war wages and war bonus to employees during 1917–18 was £321,125, the total sum paid in this respect since the commencement of the war to March 31, 1918, being £497,013.

Rates, Maintenance of Paving, and Street Widenings.

The total sum paid to Metropolitan Borough Councils as rates on the permanent way amounted in 1917–18 to £65,179 15s. 9d., and represents an average relief to the rates of London of about $\frac{3}{16}$d. in the £. This amount of £65,179 15s. 9d. is in addition to rates and taxes paid by the Council in respect of tramway offices, car sheds, sub-stations, depots, etc.

The saving to the road authorities in consequence of the obligation of the Council to maintain the paving along the tramway routes is estimated by the Council's officers at about £184,000 a year on the present mileage; this estimate being based, of course, on the normal standard of maintenance.

The aggregate amount chargeable to the tramways account in respect of the cost of effecting street improvements carried out along tramway routes, under resolutions already passed by the Council, is approximately £800,000, of which £736,951 had already been so charged up to March 31, 1918. The amount estimated to have been paid to tramway companies (as part of the purchase money for their undertakings) in respect of the expenditure incurred by them on street improvements is £40,576, the whole of this amount being charged to the tramways account.

The amount actually charged to the tramway's revenue account during the year 1917–18 in respect of rates on tracks (£65,180) and debt charges on street improvements (£36,040), together with the estimated saving to local authorities on maintenance of paving (£184,000), gives a total of £285,220, and various rates were therefore relieved to this extent.

Fares—A Canadian View.—The Niagara Falls *Review* very naively remarks:—"There may be some truth in the statement that our local street railway line is not a money maker; but when taken over by the city the rate can be increased if necessary." And yet, remarks the Canadian *Electrical News*, if the private owners asked for an increase in order to improve the service it would doubtless be called "impudence," following the precedent established by the Mayor of Toronto.

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FINANCIAL REPORTS AND MEETINGS.

SOUTHAMPTON CORPORATION TRAMWAYS will contribute £8,000 to the relief of rates for 1919-20.

HONG KONG TRAMWAYS COMPANY have declared a further dividend of 10d. per share, making 28½ per cent. for the year, against 23 per cent. last year.

MANILA ELECTRIC RAILROAD AND LIGHTING CORPORATION.—A dividend has been declared of 1½ per cent. (1·50) per share for the quarter ended March 31.

THE MIRRLEES WATSON COMPANY have declared a dividend of 10 per cent. and a bonus of 2½ per cent., both less tax, for the past year. The rate was the same a year ago.

DUBLIN AND BLESSINGTON STEAM TRAMWAY COMPANY.—A dividend of 5 per cent. for the year ended December 31, 1918, has been declared on the baronial guaranteed shares.

EAST HAM TRAMWAYS DEFICIT.—It is estimated that the deficit on the East Ham Corporation Tramways for the year ended March 31 will be equivalent to a rate of 6¼d. in the £, as the deficit will amount to £13,980. The estimated deficit on the electricity undertaking is £8,860

PAISLEY DISTRICT TRAMWAYS COMPANY.—A dividend is announced at the rate of 5 per cent. per annum (5s. per share) on the preference shares for the half year, making 5 per cent. for the year. A sum of £16,000 is added to the general reserve, making £100,211, £5,000 to income-tax reserve, and £6,072 is carried forward.

BRITISH INSULATED AND HELSBY CABLES, LIMITED.—A dividend at the rate of 8¾ per cent. has been declared for the half year, making 12½ per cent. for the year on their revised capital. A sum of £80,000 is carried to reserve and depreciation, and £99,000 is carried forward. Last year the dividend was 7½ per cent. with a bonus of 10 per cent., making 25 per cent. for the year on the old capital.

CITY OF OXFORD ELECTRIC TRAMWAYS.—The directors recommend a dividend at 4 per cent. for the year 1918. The gross profit amounted to £10,454. After deducting debenture interest and amount transferred to sinking fund for redemption of debentures, etc., there is a balance of £6,234, or, including £2,035 brought forward, £8,269. Five thousand pounds has been allocated to depreciation on motor omnibuses and chars-a-banc, and after the payment of dividend, £685 is carried forward.

HULL CORPORATION TRAMWAYS.—The chairman reported at the last meeting of the Tramways Committee that the rough balance sheet for the financial year showed a total revenue of £234,770, and an expenditure of £224,757, leaving a balance of £10,018. He considered that very satisfactory considering the enormous expenditure. They were paying £40,000 a year more in wages than before the war. The total capital invested is £600,000, and on this the profit was £10,000. For the last five years they had lost £50,000 in halfpenny fares.

WEMYSS AND DISTRICT TRAMWAYS COMPANY, LIMITED.—The report for the year ended December 31, 1918, shows that the profit amounted to £7,530, and with £828 brought forward there is an available balance of £8,558. After paying interest on mortgage debenture stock, £1,583, and placing £200 to the fund for the redemption of stock, a dividend at the rate of 6 per cent. on the preference shares and a final dividend at the rate of 6 per cent. on the ordinary shares is recommended. Three thousand pounds is transferred to general reserve, and £1,045 carried forward. The traffic receipts for the year amounted to £22,021.

KILMARNOCK ELECTRIC TRAMWAYS.—The accounts of Kilmarnock Corporation Tramways Department show a total gross income of £11,144, against an expenditure of £10,004. When loan charges, interest, sinking fund, and other requirements, amounting to £3,605, have been deducted, there remains a deficit of £3,355 to be met by assessment. The average fare charge per mile is 0·86d., and the average earnings per car-mile is 10·77d. The car-miles run during the twelve months totalled 245,828; number of power units used, 362,769; the number of passengers carried being 2,990,530. Operating expenses per car-mile, excluding power cost, were 7·922d., including power cost, 9·767d.

PARA ELECTRIC RAILWAYS AND LIGHTING COMPANY.—Presiding at the annual meeting, Mr. Follett Holt said that the earnings for the year had been adversely affected by the economic depression and the disturbances of the last year of the war, while a violent epidemic of influenza had paralysed the public services. Operating expenses had further increased, owing to trade restrictions and higher wages. As a result the balance carried to profit and loss, after allowing for exchange differences, had decreased by £8,782, or about 7 per cent. The directors, however, felt no anxiety at the decrease, and it did not indicate a standstill in the development of the business. With their liberal allocation to renewals and reserve, it was a satisfaction to the board to recommend the maintenance of a dividend of 7 per cent.

UNDERGROUND ELECTRIC RAILWAYS COMPANY.—Lord George Hamilton, presiding at the annual meeting of the Underground Electric Railways Company of London, Limited, described the report as the best in the history of the company. Referring to the question of the suggested increase in fares, he said that sometimes the raising of fares operated in such a manner as to reduce the revenue. Alterations under the present conditions would require very grave consideration. The shorter working day now becoming general would add heavily to their working costs, and further fare adjustments were now being made to meet them. The Associated Equipment Company had had a good year. During the war its business had so expanded that it was not likely to be wholly occupied in manufacturing for the Omnibus Company. Its future must depend largely upon the commercial development of the heavy petrol-driven vehicle. There was probably no enterprise more captivated by the idea of nationalisation than the Underground. Their railways were protected by statutory powers, but their omnibuses were open to competition and attack. The omnibuses carried nearly two-thirds of the passengers, and if there was any very heavy curtailment of traffic by outside competition, the dividends of the Underground would be greatly diminished.

READING TRAMWAYS.—Mr. G. F. Craven, general manager and engineer of Reading Corporation Tramways, in a report to the Tramways Committee, says that the receipts for the years 1905 to 1912 varied between £32,543 and £34,277, but from 1913 a very rapid increase took place, which promises this year to bring the receipts to £68,000. It is impossible to estimate even approximately the revenue for the next year, because it will largely depend on a decision in regard to fares and the prosperity of the borough. While variations in wages were slight up to 1915, since then the increase has been marked, and in the present year may reach £35,000. Wages on all tramways must increase with the introduction of a shorter week. Next year more men will have to be employed in repairs to permanent way, rolling stock, and buildings. Taken altogether, the estimated wage increase of £42,000 for 1920 cannot be regarded as too high. The prices of the principal materials have increased from 200 to 300 per cent. since 1914, and quotations by manufacturers of tramway supplies continue to increase. The manager considers that the estimated cost of materials at £20,000 is quite moderate and not easily to be reduced if the tramway equipment is to be maintained in good order. After adding to the foregoing figures capital charges of £11,732, there is a total charge against revenue of £73,730. The estimated financial result for the year ending March 31, 1920, is not very reassuring, for it shows that the expenditure may exceed the total revenue by £5,730, and points to the fact that every reasonable effort must be made to increase the revenue.

BRISTOL TRAMWAYS AND CARRIAGE COMPANY.

For the year ended December 31, 1918, the revenue amounted to £749,873, and the working and general expenses and renewals to £634,775, leaving with the amount brought forward an available balance of £133,249, or an increase of £11,007. Interest on investments has been carried to the reserve fund, and after adjusting the securities to their value at December 31 last, this fund stood at £381,413. With the addition of £40,000 now proposed, and £25,000 to provide for deferred repairs, renewals, and exceptional wear and tear of plant and equipment, the total reserves will amount to £471,413. Receipts of the tramways show a decrease of £467, and of the carriage department an increase of £105,670. Passengers decreased by 2,168,651, to 61,813,124. The annual dividend rate is to be 7 per cent., the balance payment of 4 per cent., being free of income-tax, and £40,000 is once more to be reserved for contingencies and renewals. The total reserves will stand at £471,413. The option of the Bristol Corporation to purchase the undertaking was extended during the year by a further order from the Board of Trade to October 31, 1919.

A comparison of the results for the past five years is appended :—

	1918.	1917.	1916.	1915.	1914.
	£	£	£	£	£
RECEIPTS—					
Tramways department ...	284,866	285,333	254,597	248,355	239,651
Carriage department	452,738	347,089	294,081	258,530	209,512
Sundry receipts	12,269	10,381	7,229	5,500	5,611
	749,873	642,783	555,907	512,385	454,774
EXPENSES—					
Traffic expenses	295,531	236,884	187,567	175,415	174,623
General expenses	99,221	79,488	88,472	75,916	58,947
Renewals, repairs, and maintenance	240,024	213,804	174,408	162,189	138,615
	634,776	530,176	450,447	413,520	372,185
Net revenue	115,097	112,607	105,460	98,865	82,589
Balance from last account ...	18,152	9,636	5,056	—	—
Total	133,249	122,243	110,516	98,865	82,589
Interest	22,666	25,696	27,598	30,502	30,638
Interest carried to reserve fund	6,633	5,270	4,563	4,365	4,468
Dividend on 4 per cent. pref. shares	14,250	15,000	15,542	17,333	18,458
Interim dividend (June) on ordinary shares	15,000 (3 p.c.)	9,375 (5 p.c.)	10,052 (5 p.c.)	8,984 (4 p.c.)	9,396 (4 p.c.)
Final dividend for half-year on ordinary shares	20,000	18,750	13,125	12,625	11,328
Dividend rate for year	7 p.c.	6¼ p.c.	6 p.c.	5 p.c.	4½ p.c.
Addition to reserve fund	40,000	30,000	30,000	20,000	8,301
Carried forward	14,700	18,152	9,636	5,056	—

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LIVERPOOL CORPORATION TRAMWAY YEAR.

Manager's Comment on War Difficulties.

In introducing his report for the year 1918, Mr. Mallins, general manager of Liverpool tramways, says that he fully appreciates the great inconvenience caused to the travelling public owing to the depleted service, brought about by the large number of tramway employees who have joined H.M. Forces, and in addition the difficulty of obtaining material and new rolling stock. The enormous increase in the traffic as compared with pre-war times has also been a factor over which the committee and management had no control. Out of a total staff of under 3,000, no fewer than 2,300 left the tramway service to join the forces. Among these were many skilled mechanics who were engaged in the maintenance of the rolling stock. The difficulty of dealing with the traffic is obvious when it is stated that the number of passengers in 1918 amounted to nearly 200,000,000, as compared with 130,000,000 in pre-war times. The public have borne the inconvenience with admirable fortitude, recognising the difficulties which had to be met. On the signing of the armistice the committee lost no time in taking action for the provision of an improved service. It has been decided to purchase 100 new motor omnibuses, as it was found that these vehicles could be obtained and placed in service much earlier than tramway cars. The omnibuses will not be run in competition with the tramway service, but will form a most desirable adjunct. Each of the systems has its sphere of usefulness if judiciously handled, and it is Mr. Mallins' opinion that the moter omnibus will in the future play an important part in obviating the present traffic congestion in large cities and towns. To augment the tramway service 100 additional tramway cars are being provided and new electrical equipment is being purchased to put the whole of the rolling stock in an efficient state of repair. Up to the time of the armistice the Lambeth Road car works were largely occupied in the manufacture of shells and aeroplanes.

Mr. C. W. Mallins further frankly expresses his opinion of the methods adopted by the Government in connection with the supplies of material and the substitution of labour, which to say the least, he remarks, appear a little strange to the ordinary business man. There have been numerous Government Committees formed, and legions of officials appointed, whose principal occupation was apparently to send out a large number of forms with peremptory orders to tramway managers to have them filled up and returned. These forms had to be filled up by depleted tramway staffs, who in many cases could ill afford the time to perform this work. It is the opinion of many that the utility of these forms would not justify the time and stationery expended upon them, especially having regard to the fact that the result, so far as assisting tramway undertakings in obtaining supplies of material and labour was concerned, has been generally of a negative character.

Financial Results.

The results for the year ended December 31, 1918, compared with those of the four preceding years, are as follow :—

	1918.	1917.	1916.	1915.	1914.
	£	£	£	£	£
Capital expenditure ..	2,068,395	2,068,430	2,068,453	2,068,453	2,062,391
Loan outstanding ..	950,988	998,244	1,008,694	1,212,713	1,168,685
Traffic revenue ...	962,538	818,756	738,321	696,893	684,026
Total revenue	989,504	845 645	766,577	726,078	722,307
Working expenses ..	716,479	575,267	518,037	488,274	473,678
Gross balance	273,025	270,378	248,540	237,804	248,629
Net profit	169,322	167,243	145,971	123,193	134,821
Average fare per passenger	1·184d.	1·137d.	1·124d.	1·109d.	1·127d.
Traffic receipts per track-mile	£7,762	£6,602	£5,954	£5,620	£5,516
Traffic receipts per car-mile	18·91d.	15·56d.	13·97d.	13·20d.	12·02d.
Power cost per car-mile	2·740d.	2·584d.	2·490d.	2·348d.	2·171d.
Operating costs per car-mile	14·082d.	10·880d.	9·798d.	9·240d.	8·323d.
Total charges per car-mile	16·120d.	12·890d.	11·738d.	11·409d.	10·322d.
Ratio of expenses to revenue	72·40%	68·02%	67·5%	67·2%	65·6%
Total track mileage ...	124	124	124	124	122
Number of cars in stock	—	598	598	599	596
Car mileage	12,210,763	12,630,577	12,688,163	12,682,018	13,657,888
Passengers carried ...	195,082,609	172,842,494	157,636,595	150,755,680	145,656,374

Need for Increased Fares in New York.—Mr. Theo. P. Shonts, president of the Interboro Rapid Transit Company, which operates the subway and elevated railways in the boroughs of Manhattan and the Bronx, New York City, states in a letter to the City Council that unless an eight-cent fare is granted the company faces bankruptcy. The present fare is five cents (2½d.) for any distance, and the company now finds its expenses so high that there is a loss on every passenger. It consequently desires to increase the uniform fare to 4d.

PERSONAL.

Councillor James Cavey has been appointed chairman of Wigan Corporation Tramways Committee.

Mr. E. H. Bond, general manager of Dover Corporation Tramways, has been granted a war bonus of £25.

Mr. Peter Fisher, general manager, Dundee Corporation Tramways, has received an increase of salary to £700.

Mr. C. D. Braidwood, of Leeds Corporation Tramways department, has been appointed superintendent of the Metropolitan Electric Tramways.

Mr. H. F. Street, who has been borough electrical engineer of Southampton for the past 18 years, has, owing to eye trouble, tendered his resignation.

Sir Maurice Fitzmaurice, C.M.G., has resigned the chairmanship of the Canal Control Committee, and **Mr. Sidney Preston** has been appointed as his successor.

Mr. C. D. Flint, for many years advertising manager of the Edison-Swan Electric Company, has started business as an advertising agent at 190, Fleet Street, E.C.

Mr. Benjamin Hall, of Keighley, has been appointed rolling stock superintendent, works manager, and engineer of Wigan Corporation Tramways at a commencing salary of £250, rising to £300.

Mr. William Billington, assistant to the general manager of Salford Corporation Tramways, has been appointed general manager of Wigan Corporation Tramways at a commencing salary of £450, rising by two annual increments to £500.

Mr. S. L. Pearce, chief engineer and manager of Manchester Corporation electricity department, has been granted an increase in salary from £1,500 to £2,000 per annum. **Mr. W. E. Foden,** financial superintendent, has been granted an increase from £500 to £600 per annum.

Mr. T. Metcalf, who has been manager of the Swindon Corporation Tramways, has been appointed general manager by the Tramways and Electricity Committee, and **Mr. F. Newey,** who has hitherto been acting electrical engineer, has been appointed electrical and mechanical engineer.

Captain C. Burgess, R.E., general manager of the West Hartlepool Corporation Tramways, has resumed his duties. Captain Burgess has been absent on service since 1915, and has been two and a half years in Mesopotamia.

Mr. P. F. Sullivan, at a meeting of the Institution of Civil Engineers of Ireland on March 3, read a paper on "Tramway Curves and Special Work." The paper was accompanied with plates of various forms of curves, which were dealt with from a mathematical point of view.

The King of the Belgians has been graciously pleased to create **Mr. Philip Dawson,** M.Inst.C.E., M.I.Mech.E., M.I.E.E., "Chevalier de l'Ordre de Leopold," in recognition of his services as a member of the Belgian Royal Commission on the electrification of the Belgian State Railways.

Mr. G. G. L. Preece, Lieutenant, Lancashire Fusiliers, T.F., and R.E., has been demobilised and has returned to his old post as branch manager of the Manchester district for Messrs. Bruce, Peebles and Company, Limited, Edinburgh. His address as before is 30, Cross Street, Manchester.

Mr. Charles E. Inglis, University lecturer in mechanical engineering, has been elected to the professorship in mechanism and applied mechanics at the University of Cambridge, in succession to the late Professor Bertram Hopkinson. The stipend is £850 per annum, with £450 from the receipts of the department.

Mr. Robert M'Creary, who is at present serving as a major in the Royal Engineers, has been appointed assistant permanent way engineer on the Belfast Corporation Tramways. Major M'Creary is a native of Belfast, and was educated at the Royal Academic Institute, taking his degree at Queen's University.

Mr. E. W. Cockerlyne has been appointed highways and tramways permanent way engineer of Leeds Corporation, in succession to Mr. R. B. Holt, who, as mentioned in a recent issue, has resigned that position in order to accept an appointment on the staff of Messrs. Sandberg, consulting engineers, of Westminster.

Mr. J. H. Shaw, deputy electrical engineer of Bradford Corporation, has resigned his appointment, and will become the representative of the Davenport Engineering Company, Messrs. Hick, Hargreaves and Company, and J. Shaw, Son and Greenhalgh, with offices at Temple Chambers, Temple Avenue, London, E.C.

Mr. W. Clough, who recently resigned the general managership of Bury Corporation Tramways department, in order to accept an important position in the paper manufacturing industry, has been presented by the chief officials with a silver tea set as a mark of their appreciation of his services to the Corporation for twenty-six years

The salary of **Mr. Arthur Ellis** as tramways engineer and manager of Cardiff Corporation Tramways has been increased from £500 to £750 a year. As chief engineer and manager of the electricity

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department, Mr. Ellis receives in addition a salary of £500. The salary of **Mr. C. G. M. New,** deputy manager of the tramways, has been increased to £525 per annum.

Mr. E. Sidgwick, who was recently appointed superintendent of Southport Corporation Tramways, has been presented with a solid silver fruit dish and a pair of silver vases from the employees at Rochdale, where he has previously been rolling stock superintendent. Mr. George Webster, general manager, spoke highly of Mr. Sidgwick's services during the past 11 years, and Mr. A. Marsden made the presentation.

Mr. T. Inglis Rudman has taken up his duties as tramway permanent way engineer for Sunderland Corporation at a salary of £300 per annum. There were 17 applicants for the post. Mr. Rudman served his articles in the Midland Railway civil engineering department at Derby, and afterwards was resident engineer at Aberdare, Norwich, and on the Tyneside, and has since been surveyor in the works department of the Ministry of Munitions at Bristol. He has had much foreign experience in Costa Rica, the Argentine, Chili, Peru, and Panama. Just before going to Sunderland, Mr. Rudman was with Messrs. Clegg and Sons, a Manchester firm of engineers.

The death of **Mr. T. P. Tierney,** after an attack of influenza, has taken place at Monkstown, co. Dublin. Mr. Tierney was formerly connected with the Dublin United Tramways Company, and was well known in Ireland as a consulting engineer.

We regret to record the death of **Mr. W. H. S. Dawson,** city engineer of Bradford, which took place on Saturday last at the age of 58. Mr. Dawson was responsible for the construction and maintenance of the permanent way of the tramways.

TRAMWAY AND LIGHT RAILWAY NOTES.

BELFAST.

INFLUENZA AMONG CAR EMPLOYEES.

Mr. J. S. D. Moffat, general manager of the Corporation tramways, recently reported to the Tramways Committee that they were severely handicapped owing to the large number of motormen and conductors laid up with influenza. The maximum number away at one time was 92, that number later being reduced to 62.

BIRMINGHAM.

SIX MONTHS FOR DELIVERY OF NEW CARS.

At a meeting of the Tramways Committee it was announced that an order had been placed for fifty new cars. The total number of cars in service is now 586, and several of the new cars will be replacements. The chairman, Councillor Lee, stated that considerable difficulty had been experienced in obtaining rolling stock, and it would be more than six months before any of the new cars could be delivered. Attention is being given to track renewals, but the dearth of material prevented much progress. There was, however, a prospect now of the release of more.

BRISTOL.

COAL ALLOWANCE HANDICAP—IMPROVED OMNIBUS SERVICES.

Tramway services cannot be run on Sunday in Bristol until there is an extension of the coal allowance. Several of the suspended motor omnibus services have been restored, though as a whole the service has not yet reached the pre-war standard; but other services will be resumed as circumstances allow. The company propose to meet all demands for pleasure trips in the summer as far as they are able, but shortage of labour and materials is a serious handicap.

CARDIFF.

TRAMWAY ADVERTISING TO BE CONTINUED.

At a meeting of Cardiff City Council, Councillor A. J. Howell moved the rescinding of the resolution of the Electric Lighting and Tramway Committee that on the expiration of the existing agreement the advertising on the outside of tramway cars be discontinued. He urged that with the city rates going up it was not reasonable to sacrifice the revenue to be derived from advertisements. The motion was seconded by Councillor T. Morgan, and carried by 14 votes to 11.

DUNDEE.

ELECTRIC WELDING PLANT FOR RAILS.

The tramways department have purchased an electric welding plant, and representatives from several tramways recently witnessed experiments with it. The plant, which was supplied by the Equipment and Engineering Company, of 2 and 3, Norfolk Street, London, W.C., will be used for rail repair and rail welding, and it is expected to reduce the cost by about one quarter. The plant will also be of great service, of course, in repair work in the car sheds.

EDINBURGH.

DEFINITE STEP TOWARDS ELECTRIFICATION—ADMINISTRATIVE TRAMWAY STAFF—PASSES FOR COUNCILLORS—TOP COVERS FOR CARS.

The sub-committee of the Town Council, to whom was remitted the report of the general manager (Mr. R. S. Pilcher) on the future arrangements for the construction and development of the tramways, have recommended that the cable system be abolished as soon as practicable after the tramways are taken over by the Corporation at the end of June next, and that the overhead trolley system be introduced generally, leaving special parts of the city to be considered separately. The sub-committee recommend that plans should be prepared at once, and that the first route to be dealt with should be that from Pilrig to Liberton. The sub-committee further recommend that the Corporation should acquire a number of motor omnibuses with a view to running them both within and without the city boundaries as supplementary to the tramways. The deputation from the Tramways Committee that visited London recently to inspect the working of the conduit system were favourably impressed with the facility with which the cars pass from the conduit to the overhead sections. They consequently think that the installation of the conduit system on Princes Street should be carefully considered. Mr. R. S. Pilcher, the tramways manager, has been instructed to make arrangements for organising an administrative staff. Fifty additional top covers for cars are to be provided for use next winter. By a majority of 20 to 18 the Corporation have adopted a recommendation that free tramway passes should be granted to each member. It was originally proposed that councillors should pay £3 3s. per annum for season tickets.

GLASGOW.

ALL-NIGHT SERVICE OF CARS—THE 48-HOUR WEEK—PARCEL SERVICE DISCONTINUED.

Glasgow Corporation Tramways Committee have practically decided to run an all-night service of cars as soon as the labour and materials necessary for increasing the number of available cars can be obtained. In the Corporation tramway department the 48-hour week was put in operation at the works and depots early in March, and this month it is in force among the traffic staff. The change entails a large addition in the number of employees, and, of course, to the working expenses. It has been decided to discontinue the special car service in Glasgow for the conveyance of parcels from the centre of the city to Uddingston. The experiment was made for three months at the request of the Road Transport Board, who suggested that the carriage of parcels by tramway cars to various parts of the city would remove the congestion of railway and motor traffic in these districts. The service has, however, been little used, and the experiment confirms the view expressed by the local tramway officials when the suggestion was first made.

NOTTINGHAM.

CAR EQUIPMENTS THREE YEARS ON ORDER—EXTENSIONS POSTPONED—WAGES COST AND HIGHER FARES.

Nottingham Corporation Tramways Committee have placed orders for twenty-five new cars at a total estimated cost of about £40,000, and similar in type to the Nottingham Corporation standard car which was illustrated in our issue of September 12, 1918. Three years ago the committee provisionally ordered a number of new equipments and car bodies to replace those which are worn out, and they hope to obtain delivery of these at an early date. At the present time seventeen cars are permanently disabled awaiting the installation of new equipments, and many others require extensive repairs. The Corporation are seeking an extension of time for another twelve months, to August 15, 1920, in which to extend the tramway lines to Beeston. The high price of materials and labour renders the scheme impracticable at the present time, but the Corporation still hope to carry out the work. Mr. R. H. Swain, chairman of the tramways committee, at a recent Council meeting, said that it was impossible for the penny fare to be again introduced. The minimum fare might have to be raised even above 1½d. if the 44-hour week were granted to the employees. The cost of this would be £30,000 a year, while the 48-hour week would cost £17,800 a year, or, including several other provisions under discussion, £25,000 a year. The cost of the 48-hour week already promised would amount to more than the whole of the working expenses of the department previous to the war.

PORTSMOUTH.

TWENTY-MILE RIDE FOR ALLIED SAILORS.

The Mayor of Portsmouth (Mr. J. Timpson) gave 150 Japanese and 50 British seamen a twenty-mile excursion by tramway car to Horndean and back on March 3. He subsequently entertained the party to tea at the Town Hall, and afterwards at the Hippodrome.

RHONDDA.

RESUMPTION OF THE RAILLESS SERVICE.

The running of the railless cars of the Rhondda Tramways Company between Penygraig and Gilfach Goch will be resumed at Easter. The service was suspended during the war on account of the depletion of the staff.

SUNDERLAND.

INCREASED CHARGE FOR POWER—INDUSTRIAL JOINT COUNCIL.

Sunderland Tramways Committee have agreed to pay an extra ¼d. per unit for current supplied by the Corporation electricity department, making the cost 1¾d. per unit. This will increase the yearly cost for power by about £1,200. The committee recently convened a special meeting to discuss the question of setting up an Industrial Council as provided in the constitution of the Industrial Joint Council for the tramway industry.

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YORKSHIRE (WEST RIDING).

PRESENT AND PRE-WAR COSTS OF TRAMWAY CONSTRUCTION.

At a meeting of Wakefield City Council, it was reported that a conference had taken place between a sub-committee and Mr. H. England, general manager of the Yorkshire (West Riding) Electric Tramways, upon the question of a possible scheme of tramway or motor omnibus communication to Alberthorpe and Flanshaw. Mr. England had pointed out that the cost of tramway construction at present would be prohibitive. Rails, for instance, which before the war cost £6 12s. per ton, now cost £17 10s. per ton, and only recently the Corporation of Sheffield had paid nearly £3,000 each for new tramway cars as against the pre-war cost of about £900. The cost of construction per single track mile was now estimated at from £8,000 to £10,000, as compared with £5,000 before the war. With regard to omnibuses, if the roads could be made suitable, the company would be prepared to run omnibuses at their own risk.

CONTRACTS AND ORDERS.

T. Bolton and Sons are supplying five miles of copper trolley wire to Bradford Corporation, at £571 11s.

Salford Tramways Committee have ordered 72 lifeguard cradles from Mr. Joseph Bowring, of Manchester, at £144.

The British Westinghouse Electric and Manufacturing Company are supplying gear cases to Salford Corporation Tramways.

W. T. Glover and Company, Limited, have an order from Salford Electricity Committee for 700 yards of cable at £497 3s. 2d.

Birmingham Corporation have placed an order with the Brush Electrical and Engineering Company for 50 tramway cars.

Edgar Allen and Company, Limited, have an order for points and crossings from Southend-on-Sea Tramways, at a cost of £665.

British Insulated and Helsby Cables, Limited, have received an order for rail bonds from Bradford Corporation Tramways Committee.

Walter Scott, Limited, Leeds, are supplying 200 tons of tramway rails at £17 per ton, and three tons of fishplates at £21 12s. 6d. per ton, to Wolverhampton Corporation Tramways.

Southend Light Railways and Electric Lighting Committee have recommended the acceptance of a tender of the Niclausse Boiler Company, London, for a boiler, superheater, and accessories at £12,000.

The Woods-Gilbert Rail Remodelling Company, of 170, Strand, London, W.C., are about to begin the execution of a contract with the London United Tramways Company for the remodelling of the rails on certain sections.

The Rail Welding Company, of 119, Victoria Street, London, S.W., are the successful tenderers to Salford Corporation for welding and re-treading 400 joints by the company's electrical process. The value of the contract is approximately £1,000.

Bradford Tramways Committee have placed contracts with Dick, Kerr and Company, Limited, for 26 tramway cars with complete equipments, at £1,980 each, and for 52 traction motors, complete with controllers, resistances, and circuit breakers, at £246 each.

The Associated Equipment Company, Limited, has received an additional order for thirty single-deck omnibuses from Liverpool Corporation. Including the vehicles recently ordered by the Corporation from the same company, the new fleet now under construction consists of sixty single-deck omnibuses.

Dick, Kerr and Company, Limited.—A number of contracts for tramway material have recently been placed with Dick, Kerr and Company, Limited, which—under the recent consolidation scheme embracing this and other firms—will now be carried out by the English Electric Company, Limited. These contracts include orders for tramway cars complete with equipments and for car bodies, tramway motors, controllers, etc., from the corporations of Nottingham, West Hartlepool, Morecambe, Southport, Brighton, Huddersfield, Bradford, Liverpool, Manchester, Burton-on-Trent and others.

A LARGE TURBO-ALTERNATOR FOR GLASGOW.

The English Electric Company, Limited, in which are now consolidated the interests and activities of the Coventry Ordnance Works, Dick, Kerr, Phœnix Dynamo Manufacturing Company, United Electric Car Company, and Willans and Robinson, have recently secured an order for a second 18,750-KW. turbo-alternator set for the Glasgow Corporation, being a duplicate of the machine now in an advanced stage of manufacture. This contract includes, in addition to the turbo-alternator set, condensing plant and step-up transformers, and completes Mr. Lackie's first scheme of five sets for the Dalmarnock Power Stations.

The turbine will be a single unit machine of the firm's standard type arranged to run at 1,500 revolutions per minute, and will operate on steam at 250 lb. pressure, superheated to 650° F., and exhaust into a vacuum of 29·1 in. It will be coupled to a 6,500-volt 25-cycle 3-phase alternator, having a maximum continuous rating of 24,000 K.V.A. at 80 per cent. power factor.

The machine will be of the self-ventilating type, and will be electrically connected to a bank of three single-phase oil-circulated water-cooled transformers, stepping up the pressure from 6,500 to 20,000 volts An overhung exciter will be provided, as also air and oil cooling plant for alternator and transformers respectively. The condensing plant will be of the Willans surface type, with duplicate air extraction plants on the Willans rotary water jet system and extraction pumps in duplicate.

PATENT LIST.

Abstracted for "The Tramway and Railway World" from the Official Journal of Patents.

***** If the inventions have been communicated the names of the communicators are given in italics.**

APPLICATIONS FOR LETTERS PATENT.

The number of the patent is given in brackets.

Automobile signals (4,958)—C. B. Amos and W. E. F. Gibson.
Trolley wheels for electric traction (4,850)—G. H. Armitage, J. H. Rogers, and S. W. Shaw.
Variable speed gear (5,080)—Sir W. G. Armstrong, Whitworth and Company, C. B. Chicken, and G. Scott.
Changing gears of toothed variable speed gearing (5,022)—A. E. Bedford.
Variable gears for motor vehicles (5,034)—W. Blair and Rudge-Whitworth, Limited.
Steering wheels of motor vehicles (4,906)—W. A. Bowen and E. V. Pratt.
Sliding crown gear wheel for self-propelled vehicle (4,900)—J. Britton.
Change-speed gears for motor vehicles (4,780)—W. C. Butler.
Safety indicators for rear of motor cars (4,851)—C. L. Clarke.
Motor vehicles (4,735)—C. R. Compton.
Adjustment of cantilever springs of automobile chassis (4,731)—A. de Coninck.
Mudguard for motor vehicles (4,554)—H. J. Duffy.
Trailer wagons for motor vehicles (5,120)—J. Dyson.
Petrol tanks for motor vehicles (4,954)—A. H. Edson and R. Youster.
Change-speed mechanism (5,087)—A. Garelli.
Change-speed gears (4,560)—W. Hemingway and Hewlett and Blondeau.
Variable speed gear (4,679)—L. N. Hirst and T. E. C. Hirst.
Pumps for obtaining pressure in tanks of motor vehicles (4,766)—A. E. E. Jones and G. W. Pearce and Sons.
Trolley for electric tramways (4,955)—G. Odierno.
Change-speed gear of motor vehicles (4,595)—C. Stokes.
Brake gear of motor vehicles (4,596)—C. Stokes.
Transmission gear for motor vehicles (4,925)—J. T. Taylor.
Change-speed gears (4,685)—T. L. Williams.
Control mechanism for change-speed gears (4,686)—T. L. Williams.
Drive and rear suspension for motor vehicles (4,632)—L. W. Winter.
Gear boxes for motor cars (5,758)—G. Bradley and A. S. Graham.
Motor vehicles (5,651)—O. England.
Electrically operated engine starters (5,617)—F. J. Gill.
Variable speed gearing (5,489)—Sir H. Grubb and Sons, J. Rutledge, and J. Ryan.
Steel rail (5,599)—C. W. Knight and L. Knight.
Railway chairs (5,171)—A. S. McGruther.
Apparatus for signalling direction of travel and stopping on road vehicles (5,807)—M. R. Moore and H. L. Zeitun.
Tipping gear for motor vehicles (5,598)—J. J. Morgan and C. B. Rush.
Electrical machines for starting, lighting, and ignition of motor vehicles (5,625)—Powell and Hanmer, W. A. Shepherd, and F. E. Wilson.
Switch or cut-out for electric starters of motor vehicles (5,627)—Powell and Hanmer, W. A. Shepherd, and F. E. Wilson.
Electrically controlled brakes (5,382)—E. R. Smith.
Speed gears (5,989)—M. J. Adams.
Apparatus for lifting motors (6,526)—H. Baron.
Wheels and transmission gear of motor vehicles (6,033)—W. Beardmore and Co. and T. Broadbent.
Friction driving mechanism for vehicles (5,913)—F. C. Beauvais.
Route indicators (6,240)—W. R. Bridgens.
Apparatus for controlling and stopping vehicles (6,304)—British Thomson-Houston Company (*General Electric Company*).
Electric loom for motor vehicles (6,489)—H. J. Butterfield.
Transmission gear and bracket for magnetos of motor vehicles (6,001)—T. R. R. Chilcott.
Variable speed mechanism and clutch (6,442)—O. D. Clark.
Disc for controlling trolley wheels (6,025)—R. J. Clarke.
Tramway and railway rails (6,023)—J. Crimmins.
Motor vehicles (6,315)—L. W. Dewing and G. Page.
Railway crossings and points (6,005)—G. J. Fisher.
Variable speed transmission gears (6,363)—H. Grimshaw.

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Variable speed gear (6,468)—H. W. Horne.
Variable speed gear (6,298)—A. E. Hudd.
Transmission gearing (6,021)—C. A. Johansson.
Rail ties (6,173)—H. J. C. Jones.
Variable speed gears (5,901)—J. E. Kriegel.
Jacks for motor vehicles (6,141)—T. Maxwell.
Lighting or starting sets of automobiles (6,364)—P. C. Samuel and C. E. Skinner.
Sand-boxes for locomotives, etc. (5,990)—J. Southworth.
Rail fastening devices (5,890)—D. A. Tenge.
Apparatus for propulsion of vehicles (6,291)—E. Bullock-Webster.
Multiplex electrical signalling systems (6,097)—Western Electric Company (*Western Electric Company*).
Motor vehicles (6,475, 6,476, 64,777, 6,478, and 6,479)—J. A. J. Evans.
Vehicle wheel axle lubricating devices (7,069)—T. Armstrong.
Starting and lighting devices for automobiles, etc. (6,788)—J. Bethenod.
Steering self-propelled vehicles (7,092)—R. Brennan and J. O'Connor.
Systems of electric power transmission (6,987)—British Thomson-Houston Company (*General Electric Company*).
Braking apparatus (6,599)—F. M. Castleman and McKenzie, Holland and Westinghouse Power Signal Company.
Chassis for motor vehicles (7,141)—J. R. Churchill.
Fluid pressure braking apparatus (7,006 and 7,007)—J. W. Cloud.
Motor vehicles (7,215)—E. J. Detmold.
Two-speed with free engine gear for vehicles (6,597)—H. M. Edmonds
Locking means for change-speed levers of motor vehicles (6,746)—A. Gay and F. R. Ram.
Automatic point actuating mechanism for tramways, etc. (7,124)—A. Grandi.
Omnibuses and chars-a-bancs (6,920)—W. J. Hickman.
Starting gear for motor vehicles (6,548)—P. C. Jones.

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Safety devices for motor cars (7,089)—R. N. Jones.
Petrol and lubricating oil gauge for motor vehicles (6,589)—S. R. Lakeman.
Automobile clutch locks (7,002)—P. E. Maurer and F. T. Snow.
Self-propelled vehicles (6,588)—W. M. Metcalf.
Means for connecting railway rails (6,925)—G. W. Miller.
Driving of motor cars (6,839)—A. C. Muir.
Steering gears of self-propelled vehicles (7,158)—W. Pugh.
Automobile worm geared driving axles (6,744)—W. L. Spence.
Splash guards for wheels of motor vehicles (6,554)—J. H. Stirk.
Mechanically propelled road vehicles (7,040)—E. R. Woakes.
Locomotives, rolling stock, and permanent way (6,759)—W. R. D. Shaw.
Electrically-driven vehicles (7,650)—H. J. Carey.
System of electric power distribution for trains (7,833)—P. Dawe.
Systems of automatic train control (7,612)—G. P. Finnigan.
Change speed and reversing mechanism (7,254)—M. Goudard and M. Mennesson.
Variable speed reduction gears (7,661)—E. E. Hardie and A. E. Steel.
Frictional driving gear for motor vehicles (7,901)—C. W. Harrison.
Motor vehicles (7,952)—T. J. Heskett.
Tramcar trolley heads (7,504)—R. Heywood and S. Smith.
Motor vehicles (7,740)—P. G. Hugh and G. Scammell and Nephew.
Steering gears for motor vehicles (7,802)—G. H. Jones.
Rear axles for motor vehicles (7,803)—G. H. Jones.
Trolley heads for electric tramcars, etc. (7,799)—S. K. Kirkland and H. R. Tidswell.
Motor vehicles (7,327)—E. C. R. Marks (*Cowan Truck Company*).
Self-propelled vehicles (7,328)—E. C. R. Marks (*Cowan Truck Company*).
Change speed gears for motor vehicles (7,691)—J. Milne.
Regenerative control of electrically-propelled vehicles or trains (7,583)—A. Raworth.
Transmission gear for motor vehicles (7,712)—C. S. H. Snow.
Suspension of motor vehicles (7,618)—Soc. Anon. Darracq.
Pedestal for tramcar trollies (7,408)—T. H. J. Thomas.
Railway and tramway chairs (7,912)—T. H. J. Thomas.
Spring systems for motor vehicles (7,477)—A. A. Watkins and Waverley Cars, Limited.
Control valves for fluid pressure braking apparatus (7,603)—Westinghouse Brake Company.
Fluid pressure braking apparatus (7,311, 7,312, and 7,313)—Westinghouse Brake Company (*Westinghouse Air Brake Company*).

Specifications Published.

1917.

Signal devices applicable as stopping and turning indicators for vehicles (19,023—*122,670*)—E. B. Roedding and E. Roedding.
Change-speed gear for motor vehicles (3,619—*104,873*)—A. E. Leymarie.

1918.

Permanent way of railways and tramways (3,535—*122,729*)—J. A. Roberts and United Alkali Company.
Controlling switches of combined ammeters and volt meters used in connection with dynamo lighting and battery charging systems of motor vehicles (14,154—*122,797*)—W. Holt and B. Brooks.
Motor road vehicles (2,563—*122,923*)—A. Horrocks.
Rear axle speed change gear for motor vehicles (2,830—*122,929*)—A. G. Canham.
Light motor road vehicles (8,544—*122,980*)—G. A. Dunball.
Means for steering motor vehicles (11,956—*122,998*)—F. L. Rapson.
Variable speed device (17,723—*123,034*)—S. Bobrovsky.
Means for controlling variable speed gears (3,596—*123,186*)—J. D. Dean.
Clutches for motor road vehicles (5,008—*123,208*)—J. D. Siddeley.
Tractor drive attachments for motor vehicles (5,144—*114,837*)—R. E. Gallagher.
Electrical speed controlling apparatus (5,774—*123,216*)—V. Bibire.
Chair for holding rails on railways (14,391—*123,282*)—D. John.
Change-speed gearing (713—*123,357*)—C. A. Allison (*Soc. Anon. H. et A. Dufaux et Cie.*).
Differential or balance gear for motor vehicles (2,979—*123,389*)—N. Isherwood and J. F. Withnell.
Apparatus for producing detonating signals for controlling the operation of trains and tramways (9,810—*123,470*)—W. L. Rowe.
Transmission gear for power-driven vehicles (1,682—*123,551*)—L. Murphy.
Variable speed gears (4,188—*123,607*)—A. E. Hudd and O. Thornycroft.
Carriage jack for motor vehicles (5,253—*123,625*)—A. Good.
Railway traffic controlling apparatus (6,342—*115,035*)—McKenzie, Holland, and Westinghouse Power Signal Company.
Chassis construction for motor vehicles (10,614—*123,681*)—C. M. Foster.
Change speed and clutching mechanism (20,798—*123,703*)—C. H. Strong.

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TRAFFIC RETURNS.

Tramway and Omnibus Undertakings in the United Kingdom.

NAME OF COMPANY OR CORPORATION.	1918. WEEKS ENDED.					1919. WEEKS ENDED.					AGGREGATE.		
	Mar. 2	Mar. 9	Mar. 16	Mar. 23	Mar. 30	Mar. 1	Mar. 8	Mar. 15	Mar. 22	Mar. 29	Wks.	1919.	Increase or Decrease.
	£	£	£	£	£	£	£	£	£	£	£	£	£
Aberdare U.D. Council	443	434	461	444	...	499	502	501	516	...	50	25,499	+ —
Aberdeen Corporation	2.172	2.237	2.204	2,127	...	2.438	2.577	2.497	2.578	...	42	108.756	+ 17,687
Ayr Corporation	331	315	342	352	...	396	394	419	424	...	44	24.464	+ 5,237
Belfast City	...	...	...	...	...	...	...	...	...	...	—	—	—
Birkenhead Corporation	1.916	1.885	1.893	1,946	...	2.039	2,167	2,215	2,159	...	51	110,986	+ 16.291
Blackburn Corporation	1,473	1,413	1.485	1,474	...	1.766	1.773	1,744	1.870	...	51½	90.217	+ 14,196
Bradford Corporation	7,190	7.003	5.775	4.986	...	9,163	9.369	9.946	9.325	...	51	472,568	+ 88.188
Burnley Corporation	1.932	1.995	1.960	2.080	...	2.577	2 629	2.715	2.768	...	—	—	—
Burton-on-Trent Corporation	373	366	362	374	...	396	402	415	433	...	51	21.058	+ 4.313
Bury Corporation	1,572	1,666	1,665	1.740	...	1.915	2.105	2.068	1.967	...	51	103.877	+ 20.080
Chatham and District	1,179	1,161	1.186	1.164	...	1.237	1.236	1,291	1,273	...	11	13.470	+ 479
Cork Electric	587	563	623	655	...	498	473	518	578	...	11	5.975	— 637
Derby Corporation	1,232	1,209	1,230	1,306	...	1.416	1.434	1.454	1.438	...	51	75.937	+ 13.488
Dundee City	1.588	1.547	1.566	1.558	...	1.980	1.997	2.018	2.063	...	44	86.283	+ 17.311
East Ham Corporation	1.291	1.241	1.343	1.315	...	1.543	1.520	1.714	1.674	...	50½	79.909	+ 10.694
Glasgow Corporation	26.825	26.794	27,650	28.130	...	28.444	27.916	29.459	29.113	...	42½	1,204.468	+ 88.300
Glossop (Urban Elec. Supply Co.)	174	172	178	186	...	212	234	223	224	...	12	2.554	+ 426
Halifax Corporation	2.215	2.125	2.225	2,310	...	2.632	2.748	2.669	2.836	...	50½	141.410	+ 19,679
Halifax Corp. Motor Omnibuses	50	51	48	52	...	67	72	69	68	...	50½	3.384	+ 890
Huddersfield Corporation	3.134	3.103	3.208	3.350	...	3.642	3.541	3.602	3.657	...	51	184,596	+ 22.883
Ilford U.D. Council	762	800	793	807	...	1.016	1.053	1.062	1,043	...	51	51.286	+ 12.366
Ipswich Corporation	626	...	...	...	...	666	...	...	...	...	48	35.625	+ 3.899
Isle of Thanet	162	167	194	210	...	320	324	372	344	...	24½	7.700	+ 3.379
Kilmarnock Corporation	213	216	225	222	...	263	263	269	265	...	44½	11,879	+ 2.617
Lanarkshire	3.339	3.243	3.347	3.457	...	3.505	3.423	3.542	3.706	...	11	40,989	+ 5,155
Lancashire United	...	...	...	...	...	...	...	...	...	...	—	—	—
Leeds City	11,124	10,929	11.069	11.454	...	13.986	14.061	14.082	14.312	...	51	692.035	+131,064
Leicester Corporation	4,218	4.114	4.251	4.325	...	4.859	5.068	5.096	5.175	...	—	—	—
Leyton U.D. Council	1.722	1.692	1.779	1.786	...	2.482	2.632	2.662	2.659	...	51	121.963	+ 27.340
Liverpool Corporation	16.890	16.484	16.732	17.296	...	19.767	20.823	21.068	20.819	...	11½	230.608	+ 38,790
Llandudno and Colwyn Bay	256	242	270	...	...	285	292	318	...	...	15	4.405	+ 873
London County Council	52.870	53.048	55.420	54.785	...	67.111	68.629	69.962	70.874	...	50½	3.357,824	+583.483
Maidstone Corporation	246	226	251	251	...	278	281	286	279	...	50½	14.376	+ 1,879
Manchester Corporation	23.517	23.041	23.695	24.340	...	26.143	26.953	27.481	27.617	...	51	1.336.283	+247.536
Newcastle-on-Tyne Corporation	8.577	8.452	8.495	8,906	...	8.140	8.317	8.270	8.487	...	51	449.520	+ 44,002
New St. Helens and District	...	...	...	...	...	...	...	...	...	...	—	—	—
Northampton Corporation	960	853	911	916	...	979	1.103	957	1.123	...	51	45.911	+ 2,498
Nottingham Corporation	4.868	4.650	4.802	4.782	...	6,424	6,406	6.478	6.617	...	51	296,572	+ 66,238
Oldham Corporation	...	...	...	...	...	...	...	...	...	...	—	—	—
Reading Corporation	1,145	1,088	1,203	1.147	...	1.324	1.351	1.390	1.330	...	50½	65.998	—
Rhondda Tramways	1.609	1.552	1.705	1.633	...	2.103	2,104	2.119	2.150	...	11	23.210	+ 5.603
Rotherham Corporation	1,901	2.000	1.981	2.046	...	2.054	2.060	2.030	1.997	...	51½	116.277	+ 20.877
Sheffield Corporation	12.854	13.008	12.916	13,712	...	12.558	15.528	15.979	15.873	...	51½	691.354	+ 55.746
Southampton Corporation	2.252	2.209	2.305	2.262	...	2.350	2.421	2.472	2.462	...	50½	126.444	+ 20.237
Southend-on-Sea Corporation	644	640	698	676	...	1.112	1.167	1.185	1.213	...	50	65.625	+ 22.159
South Shields Corporation	...	...	1.014	...	...	...	...	1.203	...	...	50	57.737	+ 9.276
Sunderland Corporation	2.031	2.039	1.943	2.090	...	2.742	2.715	2.793	2.756	...	51	114.895	+ 18,995
Swindon Corporation	288	268	294	284	...	290	291	288	291	...	50½	15.396	+ 1,495
Torquay Tramways	704	607	708	721	...	730	775	752	814	...	11	8.114	+ 646
Tyneside Tramways and Tramroads	897	847	895	902	...	819	847	843	896	...	12	9.189	— 215
Wallasey Corporation	1,473	1,437	1,484	1,564	...	1.886	1,992	2.029	2.024	...	50½	96.032	+ 16,623
Walsall Corporation	...	...	...	...	...	...	...	...	...	...	—	—	—
Walthamstow U.D. Council	1,128	1,113	1,201	1.237	...	1,393	1,464	1,458	1,423	...	51	72.991	+ 11.382
Warrington Corporation	770	736	739	725	...	824	823	879	851	...	51	39.949	+ 8,793
West Ham Corporation	3.592	3.614	3.733	3.683	...	4.743	4.731	4,872	4.888	...	50½	233.152	+ 47,816
Wigan Corporation	...	...	...	...	...	...	...	...	...	...	—	—	—

*** A number of undertakings suspended the issue of traffic returns for the duration of the war.

Colonial and Foreign Tramway Traffic Returns.

NAME OF COMPANY.	1918. WEEKS ENDED.					1919. WEEKS ENDED.					AGGREGATE.		
	Mar. 2	Mar. 9	Mar. 16	Mar. 23		Mar. 1	Mar. 8	Mar. 15	Mar. 22		Wks.	1919.	Increase or Decrease.
	£	£	£	£	£	£	£	£	£	£	£	£	£
Anglo-Argentine	56.938	57.977	56.612	56.890	...	58.381	60.757	64.218	62.116	...	12	674.459	+ 22.898
Calcutta Rs.	74.605	77.376	76.204	72.593	...	88.622	90.051	88.850	82.752	...	11½	1.008.221	+154.037
Madras Rs.	...	...	...	...	...	...	...	...	...	...	—	—	—
Pernambuco	4.347	4.726	4.726	4.615	...	5.421	5.686	5.275	5.281	...	11½	62.159	+ 6.116

Companies issuing Monthly Statements only.

	1917.	1918.					1918.			1919.			Wks.	AGGREGATE.	
	Oct.	Nov.	Dec.	Jan.	Feb.	March.	Oct.	Nov.	Dec.	Jan.	Feb.	March.		1918-19.	+ or —.
	£	£	£	£	£	£	£	£	£	£	£	£		£	£
Ballarat & Bendigo	3.546	3.405	3.228	4.505	...	...	3.690	3.570	3.884	4.504	...	...	40	35.478	+ 2.167
Brazilian Trac. Mlrs	8006000	7695000	8059000	7837000	...	...	8052000	7581000	8531000	8522000	...	...	52	101894000	+9.694.000
Brisbane	33,580	32.901	35.019	34.500	...	...	36.780	39.246	38.135	38.575	...	...	4	38.575	+ 4.075
British Columbia	$ 491.964	525.629	555,555	559.569	501.150	...	580.354	612.893	691.065	667.489	645.415	...	34	4.740.999	+ 756,620
Buenos Ayres L'c'z.	39,067	39.678	40.901	38.902	34,397	...	41,843	42.952	50.460	41.556	42,429	...	34	343.209	+ 39,434
Burma	28.955	27,760	26.224	25,430	22,985	...	34,848	34.407	34,593	38,265	35,926	...	30	250,730	+ 66,495
Cape Town	17.128	16.522	...	...	...	...	13,877	18.385	...	...	...	...		—	—
Carthagena & H.	2,805	3,932	4,424	4.011	4,031	5.316	2,525	2,988	2,950	3.655	2,351	2,400	13	8.406	— 4.952
Cordoba	...	...	...	12,844	...	...	...	...	...	13,942	...	...	44	145.654	+ 10.915
East India	1,229	871	1.099	1,176	1.318	...	2,044	1,947	2.048	1,970	1,689	...	30	13.612	+ 4,845
Kalgoorlie	2.795	2.641	...	...	...	...	2.835	2.933	...	...	...	...	48	30.838	+ 1.274
La Plata	4.069	3.742	4.606	4.711	4.746	5.348	5.177	5.334	5.792	5.730	5,698	6.592	13	18.019	+ 3.216
Lima	37,612	37,249	43,198	43.561	...	...	45,336	44,948	47,887	45.362	...	...	4	45,362	+ 1,801
Mamos Rs.	...	...	...	...	...	...	...	...	...	...	...	...	—	—	—
Manila	$ 157,400	159,000	169,000	167.000	...	...	214,898	214,292	236.612	231,585	...	...	52	2.326.884	+ 525.609
Monte Video	30.153	...	34.025	36.016	34,573	36.659	33.203	...	38.441	40.910	38.772	41.070	21	190.891	+ 18.558
Peruvian	$ 1047220	899,680	1101090	1189350	925,410	...	1090815	897,090	1057990	1009650	943,470	...	34	7.973.835	— 229,195
Para	...	...	23,315	24,060	...	...	...	...	23,800	24,515	...	...	8	48.315	+ 940
Port Elizabeth	3.885	3.807	...	...	...	...	2.751	3.498	...	...	...	...		—	—
Rangoon	5.667	5.358	5.438	5.361	5.662	...	6.566	6.611	6.188	6.373	5.694	...	8	12.067	+ 1.044
Toronto	$ 1043886	1052000	...	1068319	981.933	...	1048478	1071106	...	1106840	1015797	...	8	2.122.637	+ 72.385
Winnipeg	$ 301,772	305.881	...	334.642	298.899	...	295,005	283,721	...	390.539	371.162	...	8	761.701	+ 128.160

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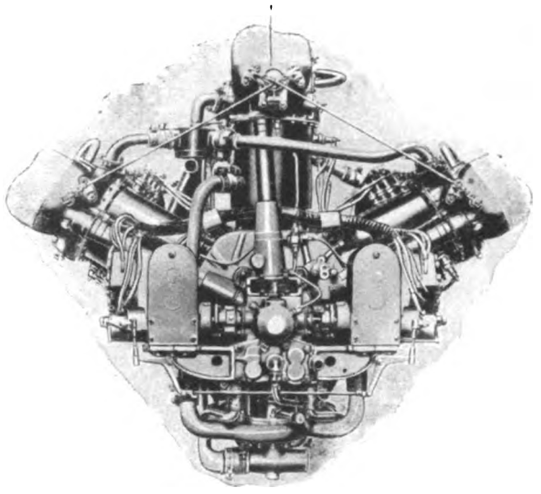
NAPIER

BRITISH **BUILT**



¶ The Napier was the original six-cylinder car--since copied throughout the world.

¶ The Napier Aero Engine is the FIRST AND ONLY engine that has attained an altitude of 30,500 feet. This astounding world's record is the more remarkable having regard to the fact that the **total weight of the machine, pilot and observer, with load, was 1 ton, 10 cwts., 80 lbs.**

¶ As a precursor of this remarkable world's record, it is interesting to note that the Napier Car was the FIRST AND ONLY British Car to have won the International Gordon-Bennett Trophy.

¶ Again—the Napier six-cylinder is the FIRST AND ONLY car to have conquered the European Alps under the official observation of the Royal Automobile Club.

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MOTORS

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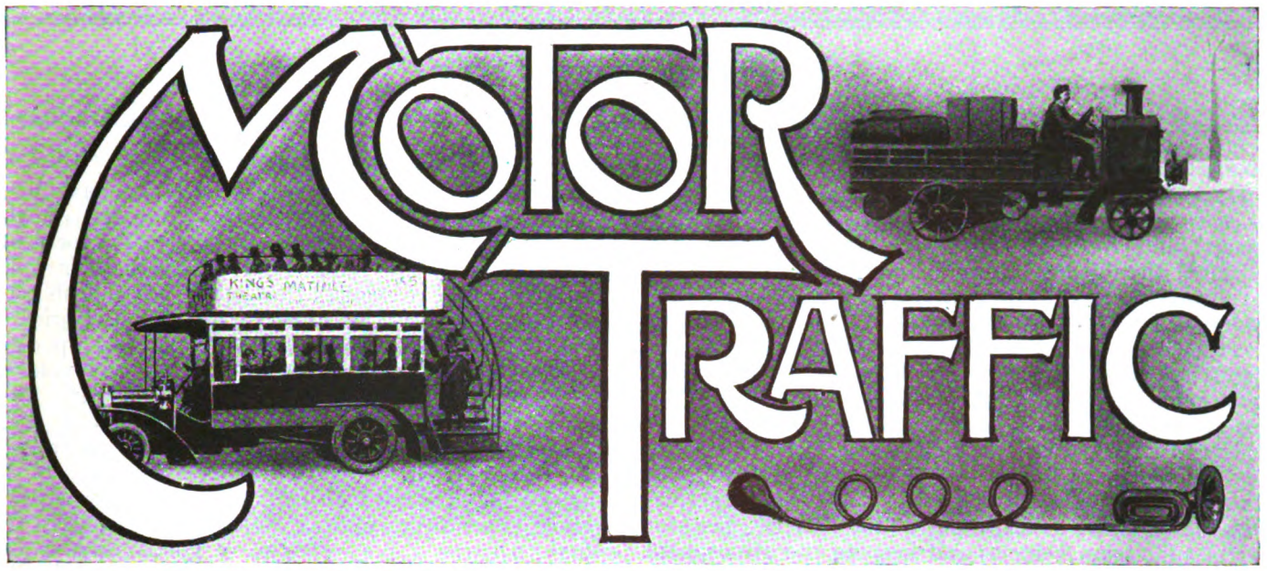

THE SLOUGH MOTOR DEPOT.

There was a similarity in the defence by Government in both Houses of Parliament of the determination to proceed with the erection of the motor repair depot at Slough that bodes ill in more ways than one. We are surprised that none of the experts of the industry in the Commons was courageous enough to point out the unsoundness of the latest argument with which Lord Inverforth and Mr. Churchill sought to bolster up the waste of money that the scheme has entailed. Both the Minister of Munitions and the Secretary for War suggested that when the Ministry of Munitions gives place to the Ministry of Supply it will be the duty of the new department to furnish motor vehicles to the War Office, the Admiralty, the Post Office, the Office of Works, the Stationery Office, and other departments. The Government's defender in the Upper House also suggested that it would be a matter for the Ministry of Ways and Communications to consider whether advantage could not be taken of the depot to secure the greater facilities for road transport, whether of passengers or goods, required for opening up the rural districts. These suggestions constitute a further menace to the industry which more than any other trade contributed to the winning of the war. The disclosure of the Government's proposals indicates the desertion of the loudly proclaimed intention not to continue the ownership of any national factory to be engaged on work that would compete with private enterprise. When the renovation of the 80,000 vehicles acquired for war purposes has been effected, what task will there be to occupy the attention of the Slough depot, which covers an area nearly twice the size of Hyde Park? No doubt a considerable number of the vehicles will be handed over to the departments already mentioned, but the total will not be large enough to justify the retention of the depot. Consequently the next step will be to start manufacturing, thus dealing another blow at the British motor industry, which, as the result of working for the Government during the past four and a half years, has to recover its home and foreign trade.

* * * * * *

The looseness of the Government's consideration of the problem is shown by Lord Inverforth's statement that it is estimated that the repair of the 45,000 British cars and lorries would take "two, three to four years," if entrusted to the British manufacturers; but he did not venture to indicate how long Slough will require to renovate the 35,000 non-British cars for which it was proposed from the first that the Government should be responsible. Nor did he attempt to say what period will be occupied by the Slough magicians in repairing the British-made machines. It is to be feared, however, that the delay will be so prolonged that many of the vehicles will be out of date. Consequently, still less reliance is to be placed upon the new peer's assertion that "if the repair part of the scheme is completed, and our motors repaired, the difference in the disposal value will be sufficient to show a profit of £1,200,000." The probability is that the State-repaired cars and lorries would be a drug in the market, their sale being killed by the enterprise of manufacturers supplying a superior machine, replete with improvements suggested by war experience. This would give manufacturers some set-off against the loss of the opportunity of supplying their goods to the Government departments. We need not comment here on the tactics of the Government in seeking to divide the House of Commons after Mr. Churchill had welcomed the opportunity of joining the House of Lords in their decision to set up a Select Committee of Inquiry. The manœuvre was readily understood by the Commons, which has much to complain of in the treatment it has received in its attempts to deal with the matter. It is to be feared that the investigation will come too late to effect any reduction in the waste of £1,100,000 already expended, but it is possible that the report may have the effect of curtailing the range of the activities of the Slough depot. The proper course to pursue would be to retain only sufficient of the works to provide for the requirements of the army and navy, and to sell the remainder of the buildings and site. That step ought to have been taken when the armistice came into operation, instead of placing the work in the hands of a contractor to complete. The least that could have been done in justice to the taxpayers was to adopt the suggestion contained in the report of the Select Committee on Expenditure in November last, namely, that the estimates should be submitted to independent expert examination, and that the Government should review the question of proceeding with the works. That recommendation was ignored, although the present gigantic scheme was not contemplated in June, when the Commons permitted the continuation of the proposal to erect works to take the place of those jeopardised in the German advance.

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MOTOR TRAFFIC

MOTOR TRAFFIC AND THE CHANNEL TUNNEL.

During the last few weeks the prospect of the early construction of the Channel Tunnel has come much nearer, and there arises the question whether such a tunnel should provide for a roadway in addition to a railway. The difficulty in the way of effecting this undoubted extension of its utility is considerable. As the railway traffic through the tunnel will be operated electrically, the problem of ventilation will be very much simplified. A roadway would be of little use unless its service were available to all vehicles which required to use it, or at any rate to all mechanically propelled vehicles. At the best the journey through the tunnel by road would not be attractive, and the problem of disposing of the exhaust gases of petrol and steam vehicles and keeping the atmosphere reasonably clean would be a very troublesome one. Obviously the provision of a roadway would add very materially to the cost of the construction of the tunnel, and probably also to the time spent before it was completed and ready for traffic. Altogether, it is questionable whether anything more than a railway is really justifiable, but if this is the decision reached by those who have the determining voice, thoroughly adequate arrangements must be made for the prompt transport of road vehicles from one end of the tunnel to the other. There must be a well thought out organisation by means of which motor vehicles can be run straight on to suitably designed trucks and adequately secured in position. The organisation should be such that trucks will not be kept waiting standing about, but will be hitched on to the next train and taken through without delay. There must be no stupid regulations about the removal of all fuel. Nothing of the kind should be necessary, and what is required is to drive the car on to the truck under its own power, and when the journey is completed to remove it again under its own power without delay. A system of this kind would be very useful in assisting the establishment of direct services by road between this country and the north-west of Europe.

"MOTOR TRANSPORT SYSTEM WILL HOLD ITS OWN."

With reference to the proposal for establishing light narrow gauge railways in the agricultural districts, Sir Eric Geddes made some interesting remarks in his speech on the Transport Bill, showing that at least so far as he is concerned one form of this scheme is hardly likely to find favour. He was largely responsible for the extension of these light railways in the army zones in France. The lines were intended, however, as temporary expedients, and the cost of maintenance of one class of such tracks would, in the opinion of the future Minister of Transport, be so heavy that their use in agricultural districts would be throwing away money. In certain places light railways might prove effective, but their application could not be general. It is suggested that in this country light electric railways may be employed for interurban traffic. On the other hand, in the agricultural areas a big development of motor traction may be expected under the new Ministry. Such districts can be better opened up by roads than by any form of light railway, particularly where gradients are frequent and severe. As Sir Eric Geddes says, "The motor transport system held its own in France and will certainly hold its own in this country."

PRICES OF POST WAR MOTOR VEHICLES.

In some quarters unreasonable attacks have been levelled against the British motor industry on the grounds that it is asking exorbitant prices for post-war products. The commercial vehicle user is more reasonable. He recognises that as the price of his own product has gone up, he must expect that the price of the machinery he purchases will have gone up also. Roughly, as regards the substantial commercial vehicle, we have to face an increase of 50 or 60 per cent. Perhaps the fairest way of looking at the matter is to consider not only cost of the vehicle, but the selling value of the load which that vehicle carries. If the selling value of a full load be double what it was, then a given expenditure upon a motor vehicle enables the owner to carry a bigger value of goods than would have been possible by that same expenditure in the past. Then, too, first cost is not the only item which a motor user has to consider. Operating cost is still more important, and amounts in the aggregate to a far larger sum. Allowing for increase in first cost, and for other increases in such costs as wages and fuel, it will be found that the total expenditure involved per mile has gone up by about 50 per cent., or, in the case of a three-ton vehicle, say from 8d. to a shilling. Suppose that in this machine there is carried a load of three tons of some commodity previously worth £20 a ton, and now worth £40 a ton, and that it has to be conveyed over a distance of thirty miles, the extra cost of transport is 10s, the original cost being about 20s. Thus, on the old figures, transport added about one-sixtieth to the price which had to be charged for the stuff, bringing it up to £61 instead of £60. With the new figures, the addition of 30s. for transport puts the total up from £120 to £121 10s. In this case transport has added only one-eightieth to the cost. In fact, it represents a smaller percentage than it did a few years ago. If each case were analysed in this way, it would be found more often than not that the percentage of cost due to transport has gone down, despite the increased price of the vehicle and of its fuel.

* * * * * *

A great many people make the mistake of confusing the cost of a car with the total cost of motoring. Such confusion leads to the assumption that if, say, the cost of a car is doubled, then the cost of motoring is also doubled, and a great many people can no longer afford to indulge in it or to utilise motors in connection with their trade. A very simple example will show how incorrect this reasoning is. A motor omnibus may cover perhaps four hundred miles a week for fifty weeks in a year, and if it is well constructed it will probably last eight years, giving a total of 60,000 miles. If the aggregate cost, inclusive of depreciation allowance, which enables the first cost to be written off, is taken as a shilling a mile, we have a total expenditure of £8,000 on operating costs during the life of the vehicle. Suppose that the first cost has gone up from £600 to £1,000. Then this rise is responsible for a total increase of £400 in the costs incurred altogether. This represents only a rise of 5 per cent., from which it is seen that a very substantial increase in the first cost of the vehicle only corresponds to a comparatively trifling percentage increase in the total expenditure involved by its purchase and operation.

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MOTOR TRAFFIC

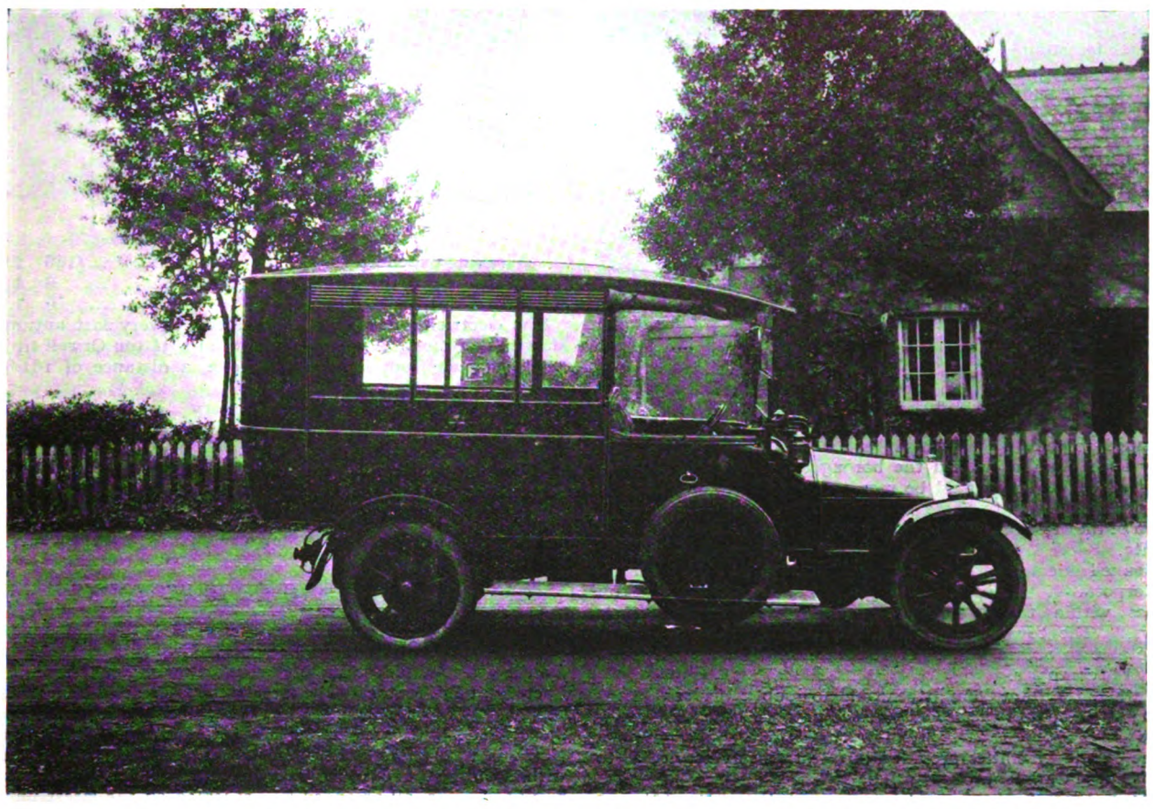
SOUTHAMPTON'S DEPARTMENTAL OMNIBUS.

A Profitable Investment by Corporation Tramways.

The appended photograph shows a departmental omnibus which has been acquired by the Southampton Corporation Tramways Committee. The body was designed and built by the department, and the chassis is a 30-H.P. Lancia, which was purchased from Messrs. T. Greenwood and Sons, of Halifax. On good surfaced, straight roads it is capable of a speed of 40-50 miles an hour, which gives it a great margin for acceleration in the important duties on which it is constantly engaged. These tasks are constantly being added to, for the vehicle's existence has become thoroughly known to all departments of the Corporation, who are eager to use it for purposes of inspections, deputations, and other municipal duties, for which it is made available at any time.

The covered interior gives accommodation for as many as eleven passengers, and it is this considerable capacity that gives the conveyance its great value. In the words of Mr. W. T. Robson, the general manager, "it is becoming more and more obvious that a vehicle of this description is quite invaluable to the Corporation, both as a convenience and economically." The charges are based on a similar scale to that adopted by motor cab proprietors, but as the omnibus carries as many as three taxi loads the department is able to arrange the hire terms at a much more favourable price.

Among the daily uses to which it is put by the tramways department are the banking of cash, taking the women conductors home at night to outlying districts, and linking up the depots. Recently it has been found useful for conveying members of the Corporation to the docks for civic farewells to overseas fighting forces—British and American—who are leaving Southampton for home almost weekly.



Southampton Corporation Tramways' Omnibus for General Service.

Petrol Supplies.—Mr. Bridgeman stated in the House of Commons that the trade stocks of motor spirits in the United Kingdom on January 1 last were 28 million gallons, and on February 1 24 million gallons, these figures showing a considerable increase as compared with the previous year. Some reduction in the price of motor spirit had been recently effected, and the prices now fixed are maximum prices, and not, as was formerly the case, prices below which spirit could not be sold.

ELECTRIC VEHICLE PROGRESS.

The March-May issue of the *Electric Vehicle* indicates the vitality of the battery transport movement in this country under the care of the Electric Vehicle Committee of Great Britain. Now that the paper supply situation has become easier, the publication extends to 48 pages, the majority of which contain articles and news showing that despite the war electric road conveyances have achieved encouraging progress. In view of the difficulty of obtaining parts from America during the last two years, there is a great opportunity for manufacturers in this country to take up work in connection with the battery vehicle. It is satisfactory therefore to note, from a five-line paragraph occupying a modest corner in this issue of the journal, that Messrs. Worsnop and Company, Limited, of Halifax, are building a new factory, covering 8,000 square yards, for the manufacture of accumulators of the nickel steel type for electric trucks and vehicles.

In an article dealing with the Ministry of Ways and Communications, the editor says:—"Any attempt by a Government department to fix the frontiers of railways, light railways, tramways, and motor vehicles would be most ill-advised. There is little likelihood that the Ministry will interfere in any way with the particular types of urban and suburban transport for which the battery-driven vehicle is adapted. But electric omnibuses and electric inter-urban services are both liable to control, and in these directions it may be necessary to take steps to secure the open road which is so essential to a new development. With regard to omnibuses, the chief legislative point at issue is that of licensing. There is little stability and no uniformity about the existing arrangements, and it would certainly be an advantage if the terms on which licences are granted could be standardised on a basis which would give reasonable security and freedom."

Commenting upon the demand for improved conditions by transport workers, another article indicates numerous directions in which running costs can be reduced and more goods handled by the adoption of battery vehicles.

U.S.A. War Vehicles in France.—No decision has been arrived at with regard to the disposal of the 85,000 cars and lorries in use by the United States Army in France.

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MOTOR TRAFFIC

LONDON AND SOUTH COAST SERVICE.

REFUSAL OF LICENCES AT BOURNEMOUTH.

Bournemouth Corporation recently refused an application by the Bournemouth and District Motor Services, Limited, for licences to enable them to run omnibuses to connect the town with all the surrounding villages, the fares in the borough to be 50 per cent. over and above the tramway fares. This procedure, the company stated, had been effective in preventing competition with tramways in other towns, and relations with various tramway authorities had been most cordial. The communication added that there was a direct service from Chatham to Hastings of 42 miles, and previous to the petrol restrictions the Brighton service ran east to Eastbourne, north to Handcross, and west to Southsea. These are now being resumed with an extension to Southampton, and it is hoped eventually to link London with the South Coast from Margate to Weymouth, the greater part of which is already covered. With regard to the roads, in the company's opinion they are quite suitable for the traffic—in fact, more so than in many towns which have both omnibuses and tramways. A single-deck omnibus of the pattern proposed is more easily managed than the present type of motor chars-a-banc. The company states that it is not absolutely necessary to have fixed places for stopping, as this takes less than one minute, the only place requiring a longer stop being at the terminus, which it is suggested would be arranged in the Square. The company would not pick up and set down the same passengers in the borough.

Before the Council came to a decision, the borough engineer reported that the highways were not constructed and are not suitable for traffic such as the institution of a motor omnibus service would involve, and that it was impossible at the present time to spend large sums on repairs or alterations to the highways which the normal use of the roads does not require. The Council were also influenced by the consideration that the time is altogether inopportune for the initiation of such an undertaking and the sufficiency of the existing means of locomotion both in and without the borough.

In a report by the town clerk it was stated that the Council, under the omnibus by-laws, granted licences for three classes of omnibuses, A, B, and C.

Omnibus of "Class A" means an omnibus starting from within the borough and going to a place or places outside the borough, and not intended to take up passengers to be set down on the route taken by such omnibus within the borough. It is Class A omnibuses for which licences would be required in connection with the present proposals. As to these by-laws, they are under the consideration of the Horse Committee with a view to their being brought up to date.

The Council is empowered, under Section 20 (1) of the Bournemouth Corporation Act, 1904, "to provide, maintain, work and run omnibuses within the borough . . . in extension of their tramways." The town clerk did not consider that the Council would be able to obtain powers to run omnibuses in the way suggested by the company.

Points which the Joint Committee would no doubt consider were :—

(*a*) The question of the necessity of the proposed service, having regard to—

(1) The existing facilities provided by the tramway service as to Poole and Christchurch.

(2) The railway facilities as to these and the more outlying districts which the new omnibuses would serve ; and

(3) The service already provided or to be provided by the 50 (or thereabouts) chars-a-bancs which the Council have already determined to licence for service between Bournemouth and towns and places within a fairly comprehensive area.

(*b*) The effect upon the roads of the borough, to whose upkeep the company proposing to run the new service would not directly contribute.

As to this the members will have seen from the recent reports of the Roads Committee that a very large expenditure is now needed upon the roads owing to their necessary neglect during the period of the war.

(*c*) The effect upon the tramways permanent way. This also will necessitate in the near future a very large expenditure, owing to the impossibility during the war of having maintained it in an efficient condition, and this expense will, of course, fall at a time when every economic condition would point to delay, if delay were longer possible.

As to the legal position of the Council with regard to omnibuses, their powers were derived under Section 37 of the Town Police Clauses Act, 1847, as extended by the Act of 1889. The Council might license such a number of omnibuses as they thought fit. He also stated the effect of the judgments given in cases in which Blackpool and Brighton Corporations were concerned, and said that each case must be considered on its merits and no general rule must be laid down. The Horse Committee recommended that the application be not entertained for the following and other reasons:

(*a*) The opinion of the borough engineer—with which the committee is in agreement—that the roads of the borough are not constructed and are not suitable for such additional traffic as the institution of the proposed service would involve.

(*b*) That the additional service would very seriously and prejudicially affect the amenities of the town from a general traffic point of view.

(*c*) That it is quite unnecessary, having regard to the facilities already provided by (1) the railway service ; (2) the tramway service, which will now, under the more favourable conditions, very shortly be greatly improved ; and (3) the service of motor chars-a-bancs which the Council have just recently decided to extend to the licensing of 50 cars.

BATTERY VEHICLE COSTS AT STOKE.

Mr. C. H. Yeaman, borough electrical engineer of Stoke-on-Trent, reporting on the cost of operation of a 3½-ton Edison tip wagon for the six months ended June 30, 1918, gives the detailed figures as follows :—

Miles run			1,930
Tons of fuel carted			2,743·14
Current at ½d. per unit	£9	3	9½
Repairs (mechanical)	13	9	4½
Repairs (battery)	2	19	8½
Driver's wages	68	3	2½
Loader's wages	67	0	6½
Sundries	5	5	7½
Working expenditure	£166	2	3
Cost per mile run	0	1	8½
Cost per ton carted	0	1	2½

The electricity department obtained delivery last autumn from Messrs. Ransomes, Sims and Jefferies of a 3½-ton Orwell tip wagon. It was driven from Ipswich to Stoke, a distance of 181·8 miles. The log of the run is as follows :—

Total ampere hours put into battery	1,587
Total units put into battery (approximately)	149
Ampere hours used per mile	8·74
Units used per mile	·82
Total running time	23 hrs. 34 min.
Average number of miles per hour	7·74

The total weight of the vehicle was 4 tons 14 cwts.

STRAKER-SQUIRE NEW WORKS.

An outstanding feature connected with the development of the motor industry since the cessation of hostilities, is the acquisition by the above-named company of the Government Aircraft engine Factory at Edmonton. The factory is located adjoining Edmonton station, which is reached in 25 minutes by rail from Liverpool Street, and sidings are already laid so that material coming from the North is trucked right into the works. The factory, constructed within the last two years, is a magnificent stack of buildings of brick and glass, all arranged and schemed on the latest up-to-date practice. A more important or imposing works, standing in 14 acres, it would be difficult to conceive, and certainly must be ranked as one of the most important motor factories in this country.

It is with this object of producing on a much larger scale than in pre-war days that Straker-Squire Limited have secured these extensive facilities. With the disruption of all motor factories, due to the war, the change-over to peace conditions obviously entails some delay in production, so that new types cannot well be expected to come through previous to the next November Show, when the new Straker-Squire "Six" will be on exhibition. In selecting a 6-cylinder type, this company will no doubt secure signal success, as with the aeroplane experience which they have acquired, it now becomes possible to produce a car of more efficient and lightened construction than was conceivable in pre-war days. This car is deduced largely on aeroplane lines, and is a development in that direction rather than on motor car design. The engine of this car certainly gives a remarkable performance, as on the dimensions of 80 mm. bore by 130 mm. stroke, 70 B.H.P. is obtained. This motor is a beautiful piece of work, and in its construction the most accurate and perfect workmanship is employed. The chassis is replete with the same light-weight principles, thus providing great reserve of power and highly efficient braking facilities, and the car altogether has the appearance of super-work. In future issues we intend to publish the designs of this chassis.

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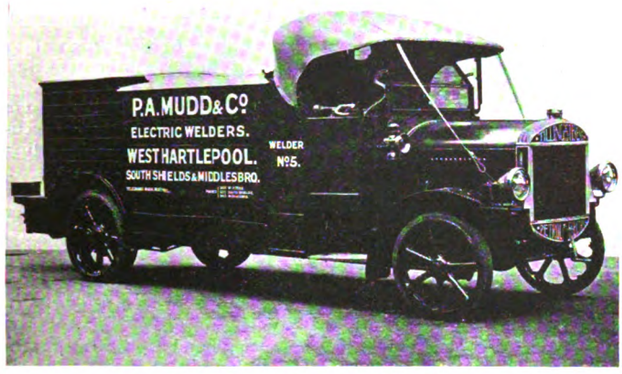
MOTOR TRAFFIC

TILLING-STEVENS ARC WELDING MACHINES.

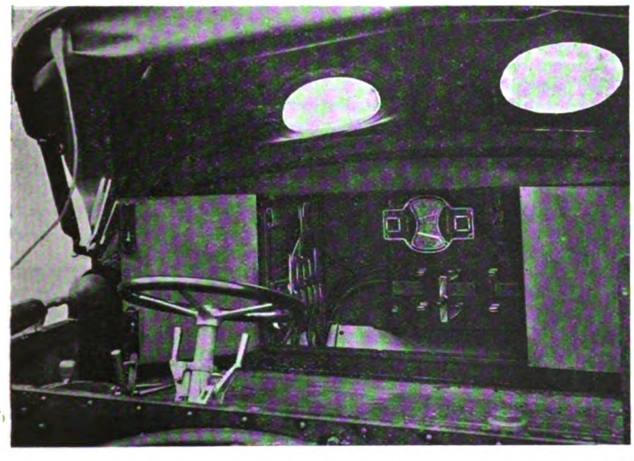
It has been claimed for the Tilling-Stevens petrol-electric vehicle that passenger-carrying is its peculiar speciality. There can be no question that the smoothness with which the vehicle will accelerate from a standing start to top speed, and the extreme simplicity of control, renders it specially suited for all kinds of passenger work, especially in large towns where frequent stops are a regular feature



Tilling-Stevens Standard Arc Welding Machine.

of the service. The field for the economic use of petrol-electric vehicles is, however, very much wider than passenger carrying, important as this class of business undoubtedly is. From the fact that each vehicle constitutes a complete electric generating plant, it will be seen that there are many uses to which the system lends itself, one of the most important being arc welding. In previous issues some account has been given of the development by Messrs. Tilling-Stevens in conjunction with their standard petrol-electric chassis of a complete arc welding outfit, the engine and dynamo which normally propel the vehicle providing the necessary current.

Three types of machines have now been standardised. In one instance the chassis is fitted with an ordinary lorry type body, and at the back of the driver's cab a compartment is provided to contain

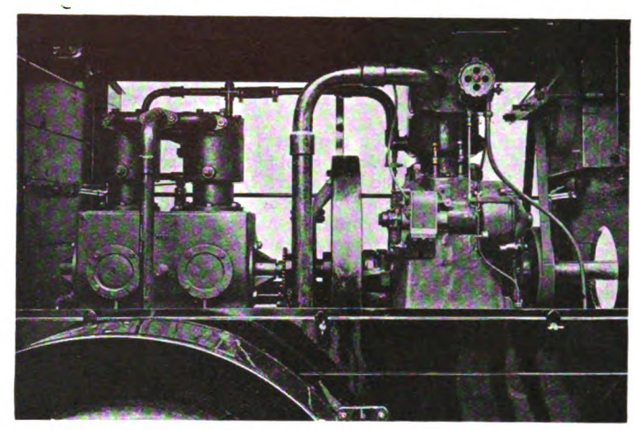


View showing Control and Resistances.

the necessary control gear and apparatus, thus enabling the vehicle to be used as a mobile arc welding plant, as well as an ordinary lorry. Another type has a box body fitted, which serves as a mobile workshop and mess-room for the operators, the welding gear being housed as in the lorry type. Each of these types are fitted with equipment suitable for supplying one arc. A third type of machine is now being fitted with equipment for supplying two arcs, one from the driving engine and dynamo and the other from a direct coupled petrol-electric set fitted in a specially ventilated box type body.

The type of machine illustrated in Fig. 1 is equipped for the supply of one arc and has been fitted with a body specially designed to suit the requirements of Messrs. P. A. Mudd and Company, who make a speciality of arc welding. The switchboard and necessary regulating resistances for welding are placed in a compartment immediately behind the driver's cab. This is enclosed by folding doors, access being obtained from the back of the driver's seat. Fig. 2 gives a view of the switchboard through the open doors. Behind the switchboard on each side of the vehicle are cupboards and lockers which contain the spare cables, electrode holders, head and hand screens, pneumatic hose, chipping hammers, etc. In the rear compartment a pneumatic compressor plant is housed; this was supplied by Messrs. Lacy-Hulbert and is capable of supplying air for operating a No. 1 Boyer pneumatic hammer.

The sides of the body are made in the form of shutters, and can be lifted off, thus giving free access to the plant. Our illustration Fig. 3 gives a view of the compressor plant, with the shutters removed. The car is completely equipped with electric lighting, this includes head lamps, side and tail lamps, a light over the switchboard in the cab, and also a light in the compressor compartment.



Pneumatic Compressor Plant.

At the present time Messrs. Tilling-Stevens have a considerable number of orders in hand for arc welding plants from shipbuilders and ship repairers, as well as a number of companies who make arc-welding their speciality.

ELECTRIC VEHICLE COSTS.

The Midland Railway Company have furnished to the *Commercial Motor* the running costs of some of their large fleet of battery propelled road vehicles, which range from a 15-cwt. van to a 5-ton lorry. Exclusive of drivers' and attendants' wages, the cost per mile on a 10,000 gross basis—excepting the 15 cwt. size, which is given a 5,000 gross mileage basis—is as follows:—15 cwt. van, 4·61d.; 30 cwt., 3·95d.; 2 tons with Ironclad-Exide batteries, 5·73d.; 2 tons with Edison battery, 5·3d.; 3½ tons with Ironclad-Exide battery, 6·74d.; and with Edison battery, 6·76d. Tire upkeep for the same gross mileage averages per vehicle, £6 8s., 15 cwt. van; £16 5s., 30 cwt. van; £22 10s., 2 ton van; and £32 for the 3½ ton vehicles. Repairs in the same order are assessed at £9 11s., £16, £20, and £25, and maintenance and attention to batteries, £4 6s., £4 6s., £10 (Edison battery 2-tonner), and £11 (Ironclad-Exide 2-tonner) and £11 (Edison battery 3½-tonner), and £12 (Ironclad-Exide battery 3½-tonner). As there is a disparity in the above prices relative to battery upkeep, the company reports that either type can be relied upon to give satisfactory results.

Omnibus Service for Walsall.—Terms have been arrived at between Walsall Corporation and the Birmingham and Midland Omnibus Company under which the latter will be allowed to run omnibuses within the borough. It will be remembered that the dispute recently occupied the attention of the High Court.

Goods of Enemy Origin Barred at Olympia.—The Society of Motor Manufacturers and Traders has decided that no goods of enemy origin will be allowed to be shown at the forthcoming motor exhibition to be held at Olympia in November next. This decision refers to cars, parts, fittings, tires, and all accessories.

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MOTOR TRAFFIC

GAS FUEL ON G.W.R. MOTORS.

In a report contributed to the March issue of the *Great Western Railway Magazine* on the experiments in the use of coal gas as fuel for road motor vehicles, the Motor Car Department state that the use of compressed gas has not made the progress expected, partly because of the difficulties in the way of changing the cylinders and partly owing to present-time difficulty in obtaining suitable cylinders. While compressed gas probably has a definite future in towns where charging stations may be set up or depots established at which exhausted cylinders can be exchanged for charged ones on the hire system, it is doubtful whether the utilisation of coal gas promises much in the direction of rural road motor services. The 27 road motor services operated by the company are, generally speaking, of long distance nature and serve isolated rural and seaside districts in similar manner to branch lines; the flexible roof container has, therefore, been adopted as the most suitable method for carrying the gaseous fuel.

The type of container which has been standardised is made double like a football, the interior gas-tight bag being of red rubber and the exterior casing of rubber-treated canvas. The advantages are (*a*) that all wear from rubbing takes place on the outer envelope, which can be easily repaired, and (*b*) that hot weather does not melt the solution in the seams, which are the weak points of a container made of rubber-treated canvas only and are pulled apart by the gas expansion.

The trays which carry the containers are designed to allow the latter to rest on slings made of webbing, and are so set up as to prevent the bottoms of the containers from rubbing on the roofs of the vehicles and also to allow free drainage and a current of air to pass between bottom of container and roof of body; otherwise the outer container tends to rot with damp at the bottom. The sides and ends of the trays are made as high as the entrances to the company's standard garages will admit so as to protect the containers as much as possible from the winds met with on routes which run over hill tops.

The problem which has given the most trouble has been the anchorage of the containers. These being of constantly varying capacity, rubber cords were first used, but they snapped off in high winds and drivers had to chase their containers over adjoining fields. Straps made of cord, webbing, and Balata belting, with and without battens of wood across the tops of containers, have been tried out. In the case of the largest container used (one of 700 cubic feet capacity) an arrangement of cords and pulleys, culminating in a weight travelling down a notched bar on the ratchet principle, has proved successful; while for smaller containers a row of eyelets round their bottoms and a second row round them at the height of the tray-sides each laced to the trays by strong cording, have solved the problem.

It has been found that the forward motion of the vehicle tends to drive the gas to the rear of the container, so the gas is drawn by the suction of the engine from the back end of these containers. The vertical filling pipe is 2½ in. and the branch to the engine 1 in. A 1 in. cock is alongside the driver's seat from which gas is drawn through a 1 in. flexible metal pipe to the gas and air mixing device which is attached to the air intake of the petrol carburettor. This device is attached to the throttle lever and works in conjunction with the latter, the gas passing in streams through a varying number of $\frac{1}{16}$ in. holes, 48 of these being in action when the throttle is wide open.

With the exception of the rubber containers all the fittings have been designed by the Motor Car Department and manufactured in the company's shops. Cars on the following road motor services are now fitted to run on coal gas:—

Passenger Services.—Neath to Pontardawe; Penzance to St. Just; Penzance to Pendeen; Paignton to Totnes; Saltash to Callington; Slough to Farnham; St. Austell to Bugle; St. Austell to St. Dennis; Stroud to Painswick; Redruth to Falmouth; Redruth to Portreath, St. Day, and Carharrack; Uxbridge to Denham; Weymouth to Wyke; Windsor to Ascot; Wolverhampton to Bridgnorth; Wrexham to Farndon.

Parcels Services.—Cardiff, Manchester, Penzance.

The consumption in the case of 3-ton passenger vehicles generally ranges from 30 to 40 cubic feet per mile, and varies with the quality of the local gas supply.

Hove Omnibus Service.—In reply to a communication from the Corporation of Hove, Messrs. Tilling, Limited, state that they cannot make any reduction in omnibus fares until substantial relief is secured in the cost of fuel, lubricating oil, and spare parts. The company also desire that greater security of tenure should be given them.

HEAVY VEHICLE REPORT.

Views of the County Councils Association.

At a meeting of the County Councils Association the Parliamentary and Highways Committee reported upon the Report of the Departmental Committee on Road Locomotives and Heavy Motor Cars, and submitted the subjoined resolutions:—

(*a*) That the sub-committee are strongly of opinion that the classification of roads should be proceeded with without delay, in view of the fact that the question of road finance cannot be settled until this is done.

(*b*) That the sub-committee approve generally of the recommendations relating to the weight, construction and speed of road locomotives.

(*c*) That the sub-committee strongly object to the proposal to increase the maximum unladen weight of heavy motor cars and trailers.

(*d*) That the unladen weight of a heavy motor car should include everything required to enable it to work upon the road, e.g., accumulators in the case of electric vehicles and water and fuel (including petrol) in other cases.

(*e*) That the unit of 840 lb. per inch width of tire of a 3-ft. diameter wheel used to arrive at the axle-weight permissible for heavy motor cars should be reduced to 616 lb. per inch.

(*f*) That the minimum diameter for wheels of heavy motor cars fitted with iron, steel, or other hard tires should be raised to 3 ft., as it is believed that this size is even at present in very general use.

Omnibus Services.

(*g*) That in connection with the recommendation that motor omnibus and similar passenger traffic should be brought under special regulations on the lines of Section 20 of the Local Government (Emergency Provisions) Act, 1916, the sub-committee desire to lay great stress upon the necessity for the Local Government Board to define what is a *bona-fide* "service" as contemplated by that section. The sub-committee also consider that any discontinuance of a service for six consecutive months should operate as a revocation of all rights previously acquired.

(*h*) That motor omnibuses plying for hire elsewhere than within a county borough, should be required to obtain a licence from the Council of any county within which they so ply for hire, such licence to cover the whole area of the administrative county.

(*i*) That with reference to the recommendation that "it should be made an offence to cause or permit the emission of smoke or visible vapour from a locomotive or motor car on a public highway in such quantity as to be a nuisance or danger to the public," the word "annoyance" should be substituted for "nuisance."

(*j*) That, as a general principle, bridges should, where necessary, be sufficiently strengthened to carry the traffic which ordinarily runs on the roads.

(*k*) That a clear statutory definition of "extraordinary traffic" is required.

(*l*) That, with the above exceptions, the sub-committee raise no objections to the recommendations contained in the report.

It was further suggested that inquiry should be made as to when the Government propose to proceed with the promised establishment of a Joint Select Committee of both Houses of Parliament to consider what provisions should be inserted in future local Bills dealing with motor omnibus services and analogous questions, and whether there should be any general legislation dealing with motor omnibus services at large.

In view of the fact that the subject of road traffic generally is to be considered at the forthcoming annual meeting, consideration of the recommendations was deferred.

SUGGESTED CONTROL OF PETROL.

A question was put to the President of the Board of Trade in the House of Commons on March 28 by Mr. Sexton, who asked whether, in view of an attempt to corner petrol supply, this commodity would be controlled under powers similar to those which were to be applied to electricity. Mr. Bridgman, Parliamentary Secretary to the Board of Trade, replied that his attention had been called to a report of the amalgamation of two large companies which dealt in motor spirit. He did not understand, however, that there was a danger of a corner in petrol. The petrol importing companies had been marketing quantities of benzol; but there was no corner in this product, and it was hoped that a large proportion of the output would eventually be distributed by the producers. A scheme for carrying out such distribution was under consideration. In these circumstances the control suggested would not seem to be necessary.

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POST-WAR DEVELOPMENTS OF THE MOTOR OMNIBUS.

By Eric Caudwell, A.M.I.A.E.

At a meeting of the Coventry Graduates' Section of the Institution of Automobile Engineers, on March 4, Mr. Eric Caudwell read a paper on "Post-war Development of the Motor Omnibus," from which the following extracts are taken :—

During the last four and a half years the development of the motor omnibus has been necessarily suspended owing to war conditions, but at the present time it has again become a problem of great importance to automobile engineers. The demand is not confined to London and the large cities, but extends to the rural districts where even in spite of war restrictions there has been a remarkable increase in motor omnibus services linking up villages with towns and railway stations. The era of rural development which has been promised to us as part of the future policy of the Government will certainly call for a great increase in road transport, and for passengers and light goods the omnibus will play an important part.

It is the intention of the author in this paper to discuss the problem of design, indicating what has been lacking in the past and showing the needs of the future. The four-cylinder petrol engine vehicle will be chiefly dealt with, with short references to steam and petrol-electric.

Requirements of a Public Service Vehicle.

First, let us try and obtain a clear idea of the essential requirements of a public service vehicle, and show where it differs from one required for private use. An average mileage for a private car may be taken as 5,000 per annum, for an omnibus as 30,000 or over. To the private owner first cost may well be more important than running cost, while the omnibus owner's profits are dependent on the time he can keep the vehicle on the road, so that it is a sounder policy to pay a high price for a first-class chassis than to have a cheap one that will require more time in dock for repairs and replacements. On the subject of these latter, it may be pointed out that every effort should be made to keep all parts likely to require renewal as simple and cheap as possible, and made to standards giving accurate interchangeability.

To return to the question of operating cost. Taking an average for a 34 passenger vehicle of 10d. per mile, and an annual average mileage of 30,000, a reduction of one penny per mile means £125 per annum, a sum that leaves a handsome additional profit after paying interest on extra capital to purchase a good vehicle rather than a cheap one. It will be readily seen that with large fleets even questions of one-hundredth of a penny per mile become of great importance.

The operating cost question also brings in the matter of weight saving. Provided it is not reduced at the sacrifice of reliability, weight has a very direct influence on running costs. One can safely say that scientific weight reduction is of as great importance to the motor omnibus as to the aeroplane Wind resistance, too, has to be paid for in petrol, and, therefore, hard cash, so that while hardly advocating stream-lining and torpedo bodies, the question is worth the attention of an up-to-date designer. Many small improvements might be made to reduce the wind resistance of present designs, such as side doors for the driver and general smoothing out of the contour.

To the omnibus owner, in his need for low operating costs and consequently increased profits, accessibility and simplicity are among the first requirements. The reliability of the service is dependent on a constant and efficient inspection and supervision, with the possibility of quickly changing any part that is not in a satisfactory condition. If any internal part, such as gear box wheel or differential pinion, cannot be attended to during the few hours per night the vehicle is in the depot, the whole unit must be removed and a new one substituted. The defective unit is then repaired and returned to stores ready for issue to another vehicle.

Having given a summary of the Metropolitan Police requirements regarding the construction of motor omnibuses, the author added that the licensing authority's pre-war requirements aim at securing a lower unladen weight than 3 tons 10 cwt., with a greater passenger carrying capacity within probably the same overall dimensions.

Advantages of Single Deck Design.

Reference to passenger-carrying capacity brings us to the subject of body design, and relative merits of single and double-deck bodies. The double-deck body has never been popular or generally used anywhere outside London, where its development has been favoured by the absence of low bridges, overhanging trees, etc., and the need for moving the maximum number of people as rapidly as possible from place to place. The body question is tied up with the matter of loading and unloading.

The double-deck body is at a serious disadvantage, in that the outside passengers are compelled to pass down a narrow staircase, and the oncoming passengers cannot get up until the others have descended. Further, in bad weather there is always the confusion caused by the scramble for everyone to get inside or *vice versa* on fine days.

It has been found out that it is not a difficult matter to design a single-deck body to seat as many passengers as the present double-deck, viz., 34. This can be accomplished by seating the driver over the engine instead of behind it. With the large single-deck body a wide rear platform can be obtained with large doors and steps to allow two people to pass abreast in opposite directions. This allows the conductor easily to regulate the people, and probably provides the best solution of the body problem. The chassis frame should be extended right back under the platform, which at present is usually hung from the rear of the body. Another point is that the floor of the 'bus should be lower than is at present in use, so that the platform can be mounted by a single step instead of two. To lower the floor means, of course, lowering the whole body with a consequent gain in stability. The single-deck is here at a great advantage over the double-deck. For country services there can be no doubt of the suitability of a single-deck body, on account of its stability, lessened wind resistance, weather protection for all passengers, and safety from overhanging trees. telegraph wires, etc.

Referring again to the question of weight reduction, it should be noted that even more important than a decrease in total weight is a decrease in unsprung weight—that is, wheels and axles. It has been proved that the chief cause of road damage is unsprung weight. The average weight of a 1,000 mm. by 100 mm. solid tyre is 1 cwt., and a present-day cast steel wheel 2 cwt., so that it will be seen that the two back wheels and four tires total 8 cwt., while the complete rear axle scales, roughly, 18 cwt. Allowing 7 cwt. for the complete front axle, this gives a total unsprung weight of 1¼ tons, or half the chassis weight of 2 tons 10 cwt.—a proportion which seems unduly high. This question will be further considered when we deal with axle design.

The metallurgical knowledge gained during the war should be of great use in enabling parts to be lightened by the employment of high-grade material, though it is probably not generally recognised to what an extent alloy steels have been already used. It seems probable that with increased knowledge of welding and light structural work it should be possible to produce an all-metal body of a lower weight than a wooden one, particularly a single-deck with no outside structure, though so little has been done that it is difficult to prophesy.

Design of the Principal Components.

We will now proceed to consider in detail the design of the principal components of the chassis.

Engine.—In selecting the type of engine, we have first to decide between the two extremes—whether it is preferable to use a large slow speed type running at low M.E.P., say, about 750 normal revolutions per minute and 75 lb. M.E.P., or a smaller engine of higher revolutions per minute and M.E.P., say 1,100 revolutions per minute and 90 lb. M.E.P. At present the former type is largely favoured, and has many advantages, such as freedom from carbonisation and consequent long holding of its tune, long wear of working parts, and general reliability. Such an engine, however, is heavy and bulky, and has a lower thermal efficiency than its rival, and this, of course, means a larger petrol consumption for any given work. It may be pointed out that, while a nominal 30 H.P. touring car engine usually runs at about one-sixth of full load, a 'bus engine runs at about one-third, and has far more work to do at full throttle. The need for reducing chassis weight and running cost points to the fact that designers will come to a smaller and more efficient engine of higher compression and M.E.P. With suitable gears, a maximum 8 H.P. of about 35 is sufficient for all ordinary routes. A smaller engine running at a high speed also enables a smaller and lighter gear box to be employed, as for the same road speed a greater reduction can be made in the rear axle.

Concluding, therefore, that the engine of the future will be smaller and lighter for the same power output, we can consider its design in more detail. The six-cylinder engine is, of course, out of the question, as there is nothing to be gained by a multiplication of small parts, and there is no call for refinement. Pair cylinders are desirable on account of ease of handling and lower cost of replacement as compared with a monobloc, and we may expect to see detachable heads to permit of ease of decarbonisation. Valves should all be on one side, operated from a single camshaft placed inside the crank case; the induction pipe may be cast in between each pair of cylinders, passing between them to the other side to a two-branch pipe bolted on. The crank case and all its fittings can follow conventional lines. The most economical system of

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lubrication is troughs fed by a gear pump, with dippers on the connecting rods. For London or cities without really severe gradients, thermo-syphon circulation is sufficient for cooling, but for country work a pump is necessary. In any case, the slight gain in simplicity with the thermo-syphon system is negatived by the extra size of radiator required.

As, in future, electric lighting will be universal, we may expect to see American practice followed, and one dynamo machine used for both lighting and ignition. As there will be no extra complications with starting motors, such a system can be rendered reasonably simple. With an efficient maintenance and inspection service, there is no reason why this should not be entirely successful, but all parts should be really well made. Most battery systems have suffered hitherto from extremely shoddy workmanship. In fact, if the high-tension magneto was as badly made as most car dynamos it would not work at all.

For engine suspension there is no better method than hanging it from two cross members by means of long bolts passing through the crank case. On some American lorries steel-stamped "I" beams are used for these cross members, and they give a better disposition of metal than the more conventional channel section, and there is no need for loose packing pieces where the bolts come.

Clutches.—There is little to be said about clutches except that there is nothing simpler than a well-designed cone type, which has fewer parts and will stand more rough handling than any other. Single and multiple clutches may be very nice for certain applications, but the author does not favour them for really hard service, although the point might be usefully raised during the discussion.

Gear Boxes.—Some of the most interesting problems centre round the gear box, and this may be realised when we consider what is required of it. An ordinary 30 H.P. car does at least 95 per cent. of its mileage on top gear, and hardly ever comes lower than second. An omnibus, on the other hand, is continually changing gear, every stop meaning a complete change up again from first, while the gears are in continual use for all but the most moderate gradients. A count was once made, and showed that a driver in London traffic changed on an average 1,200 times in a day.

Up to the year 1910 many types of spur gear boxes were in use, and all were more or less unsatisfactory, having a very short life, and being so noisy that they were a continual source of trouble with the authorities. Then at one stroke, with the coming of the X type the London General Omnibus Company solved all their problems by the introduction of the silent chain gear box. The power is transmitted by means of wide Coventry silent chains, and the wheels are connected to the shafts by dog clutches. A feature of this box is that the power absorbed by it is practically constant at all loads and speeds, as the chains are always running. On first, second, and third speeds the box takes always practically 1 H.P. This means for normal running on the level about 10 per cent. of the power of the engine, but only 3 per cent. at full throttle on low gear. The disadvantages of the chain box are, briefly, its bulkiness and weight, and consequent cost, also difficulty of obtaining a fourth speed when required without a complicated control.

Regarding the number of speeds, the designer usually has the advantage of knowing the routes his vehicle will be used on. This more exact knowledge of the conditions is helpful to scientific design, and it has been found that three speeds are sufficient for London work, and a fourth is only required for really hilly country districts. During the eight years the chain box has been in use great improvements have taken place in spur boxes. These are principally the universal use of ball and roller bearings, shorter and stiffer shafts, better means of operation, oil toughened gears instead of case hardened, and more accurate methods of making and finishing the same.

Reversion to Spur Type of Gear Box Suggested.

The time has now come to consider whether in the light of modern knowledge we cannot again use a spur type of gear box that will be equally efficient, lighter, cheaper to maintain, and have a longer life than its rival. In the author's opinion one of the chief elements of success with the chain box lies in the use of dog clutches for changing speed instead of clashing teeth into mesh. The Paris omnibuses have long used a spur gear box with all the gears running constantly in mesh and connected to the shafts with dog clutches, and the great possibilities of this type render it worthy of the fullest investigation.

Rear Axle.—Most of the axles at present in use give very satisfactory service, their chief defect being excessive weight, and it is in reducing this we must seek improvement. In the past many types have been tried—spur and bevel double reduction, plain bevel, internal gear drive, chain, and finally worm. The first two were noisy and troublesome, due to insufficient knowledge on the part of their makers. The Milnes-Daimler and De Dion internal gear drive gave a low unsprung weight, as all the mechanism was carried in the gear box, which was connected by short universally jointed shafts to the pinions, which drove the internally toothed rings on the road wheels. Unfortunately, they were incurably noisy, and had a very short life owing to the insuperable difficulty of properly enclosing the final gears.

In spite of its failure in the past, the chain drive has many attractive features. The worm-driven axle, first introduced by Dennis, or Leyland, and now widely used, has been such a great success that many would consider it as the final type, and almost the only thing to be said against it is on the score of weight. Owing to the large reduction in gear ratio and consequent low angle of the worm, heavy thrusts are set up and a very strong cast-steel casing is required to withstand them. With a double reduction axle, having a bevel for the first step and a double helical spur gear for the second, the thrusts are greatly reduced and the loads more distributed, so that an aluminium centre casing might be employed. Recent developments with machine cut spiral bevels and helical gears should render complete silence easy of attainment.

In this country the full floating axle has always found favour, although in America the live axle, with the weight of the vehicle on the driving shaft, is in very successful use. This type is lighter and has fewer parts, though the semi-floating with one bearing on the axle tube is a good compromise.

Regarding torque and radius rods, it has been found that these are quite unnecessary, as for the loads and speeds usual with omnibuses operating on main roads the rear springs can be designed to take all the driving and braking stresses.

Both brakes must be on the rear wheels. A propeller shaft brake is lighter, but it would wreck any transmission, as, owing to the weight on the rear axle, the torque obtained at the moment of wheel skidding is about three times that produced by the engine on first speed.

Road Wheels.—These have always been among the most troublesome parts of a chassis, and a finally satisfactory type has yet to be evolved. Wheels made from steel sheets pressed into shape and welded or rivetted together have been extensively employed, and it appears that such a construction may be the final type, allowing as it does the use of a reliable and homogeneous material that can be disposed in the most suitable sections to withstand the strains imposed on it. One of the most obvious ways of reducing the weight of wheels and tires is to decrease their diameter, which also has the advantage of lowering the body and centre of gravity, but we are met with the objection that the smaller the wheel the less easily does it pass over an obstacle. If, however, the unsprung weight is reduced and the vehicle springing improved, this disadvantage may be more than neutralised. The present standard tire is 40 in. by 4 in., and this could well be reduced to 36 in. by 4 in.

Frames.—Chassis frames were always a source of trouble up to the introduction of the De Dion ash and steel flitch plate construction, which from the first has always been reliable and satisfactory, although it is heavier than a steel channel of the same strength. The constant quest for improvement will, however, probably cause its disappearance in favour of a girder frame on Austin lines, or the very deep channel first introduced on American touring cars. We can see now that, as in the case of the spur gear box, the early troubles with steel frames did not arise from any inherent defect, but rather from lack of knowledge on the part of their constructors and users. The wooden frame is only a compromise, and will have to give place to a more scientific construction. Flitch plate frame for 3-ton lorry with 14 ft. 2 in. wheel base, 8 cwt. 0 qr. 14 lb.; pressed steel frame for same lorry, 7 cwt. 2 qr.; flitch plate frame for omnibus, 14 ft. wheel base, 6 cwt. 0 qr. 17 lb.; pressed steel frame for omnibus 11 ft. wheel base, 4 cwt. 1 qr. 14 lb.; flitch plate frame for omnibus 12 ft. 10⅝ in. wheel base, 5 cwt. 1 qr. 10 lb.

Springing.—Commercial vehicle springing is always a matter of difficulty on account of the large variations in load that have to be allowed for. In the case of an omnibus from zero up to two tons, present-day springs are all too stiff, and result in a high percentage of breakages. Many ingenious alternatives to the conventional leaf spring have been proposed and some tried, but until we get an entirely new system great improvements may be effected by the use of much lighter springs, in conjunction with a shock absorber that will stiffen up as the load increases.

The author next gave particulars of the London General "B" type omnibus. In concluding he said there were three alternatives to the type of vehicle with which he had been dealing, the electric battery vehicle, petrol electric, and steam. The first-mentioned may have a field of usefulness for short distance routes on fairly flat roads. The other two systems are exemplified by the productions of one manufacturer of each—Messrs. Tilling-Stevens and National Steam Car respectively.

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L.G.O.C. EFFICIENCY MEETINGS.

The sixth meeting of the fourth series of efficiency meetings of the Operating Department of the London Underground Railway and the London General Omnibus Company, Limited, was held on Tuesday evening, March 25, at the Cinema Hall, L.G.O.C. Training School, Milman's Street, Chelsea. Mr. H. E. Blain (the operating manager) presided over a crowded meeting, among those present being Mr. J. B. Thomas (general superintendent L.G.O.), Mr. G. P. Main (Board of Trade), Mr. C. J. Spencer (manager of the L.U. and M.E. Tramways), Mr. J. B. Mackinnon, Mr. Murray Griffith (District Railway), Mr. Hayward (surveyor, Battersea), Mr. W. Murray (Walthamstow Tramways), Mr. Percy Bulnois (London Safety First Council), Mr. Duke (Tilling's), Mr. Willis (surveyor, Chiswick U.D.C.). Mr. A. Winter-Gray (operating manager's department) read a paper on "Safety First—the Progress and Possibilities of Accident Prevention Work," and this was illustrated with a long series of cinematograph films and lantern slides, which greatly interested and amused the company by their humour and direct bearing on their everyday work. The paper dealt first with American methods of accident prevention and the "Safety First" organisations spread throughout the United States. Next Mr. Winter-Gray dealt with the British methods and efforts in the same direction. He held a brief for the London "Safety First" campaign, and carried the meeting with him in his undoubted claims for beneficial and profitable (from all points of view) results of "safety work." An interesting discussion followed, the Chairman, Mr. J. B. Mackinnon, Mr. A. Hutson (Claims Department), Mr. R. Johnson (Claims Assistant, L.U.R.), Mr. Murray, Drivers Rolls, Salmon, and Howells took part.

The Chairman said he thought this "Safety First" campaign was one of those things of which they might be justly proud. So far as London was concerned, the work had been a magnificent success, in fact, a greater success than when they started he thought could ever be achieved. The movement had attained a very definite objective in all their minds.

Mr. J. B. Mackinnon (general traffic superintendent, London and Suburban Company's group of tramways), in opening the discussion, said that Mr. Gray's paper was a very liberal education in the progress and possibilities of accident prevention work. There were two points of view in this campaign, viz., the humanitarian and the materialistic. On the first, it was not possible to usefully add anything to what Mr. Gray had already said, but as to the second he was convinced there would be a reduction in the number of preventable accidents. His tramways had never launched out in the campaign as the L.G.O.C. had done, but he was convinced the tramways had benefitted very materially from that work. Their accidents had been showing a decrease, and this year the figures were approximately 30 per cent. less. He thought the London Press had not done as much as it might in giving publicity to the campaign—certainly not as much as the Press in America, but perhaps they had been occupied with more important matters during the last two or three years. The London Safety First Council was to be congratulated on its work, especially as it had been done under war conditions. He thought every operating official would agree with the suggested Safety First Committees composed of officials and employees, but he joined issue on the suggestion that such committees should investigate accidents and give a verdict. Personally he would not like to be a member of such a committee to pass judgment upon a colleague, and employees were in the same position. Staffs would not like to be associated with disciplinary measures, otherwise such committees would be very useful, though he also differed on the suggestion that they should keep records, because this would mean the duplicating of the work of a responsible department.

Mr. A. Hutson (assistant divisional inspector L.G.O.C.) suggested that route maps should be issued to drivers, giving details of turnings, crossings, road repairs, etc. This would facilitate safe driving. He was of opinion that in transport undertakings sufficient work could be found for a "safety first official," or even a number of experts of that character. He was not in favour of recognised stopping places for omnibuses, because greater revenue was obtained under present conditions from short distance riders, while between the stops encouragement would be given to speeding-up; thus the object of safety first would be defeated. He urged that a substantial reward should be offered for an accepted design of a front wheel guard. Those shown that evening appeared to be rather crude. He also suggested an improvement in street signs to drivers. They should be much more "arresting," for at present they conveyed little, and he indicated how they could be improved to warn the driver as to curves, crossings, etc., which would all tend to promote safety on the roads.

Mr. R. Johnston (claims assistant, U.R. and L. and S. Traction Company) dealt with the early efforts in regard to the Safety First campaign, and asked if they had profited by the propaganda and their experience during the last three years. He thought they could all agree that great developments had taken place, and that not only the companies but also the public had profited very considerably. He did not know why tramway statistics had been omitted from the paper, because tramways had benefitted considerably. Indeed, in his own case, they seemed to have reached the high-water mark of efficiency. They had made considerable progress on the tramway side. He dealt particularly with the design of the Underground Railway by Mr. Cooper, and pointed out how it had successfully withstood claims in the courts on the point of construction. He believed there was a great future for the campaign industrially. Figures showed that even now the compensation worked out at some 5 per cent. as against 25 per cent. or 40 per cent. according to the nature of the work. This was on the railway side, whereas the figures on the tramway side were nearly as good. This aspect of affairs ought to be gratifying to the management. He agreed with Mr. Mackinnon that some of the suggestions in the paper were not practicable, and especially that the Safety First Committee of officials and employees should deal with serious accidents. When men got round a table they would not be willing to blame a fellow officer.

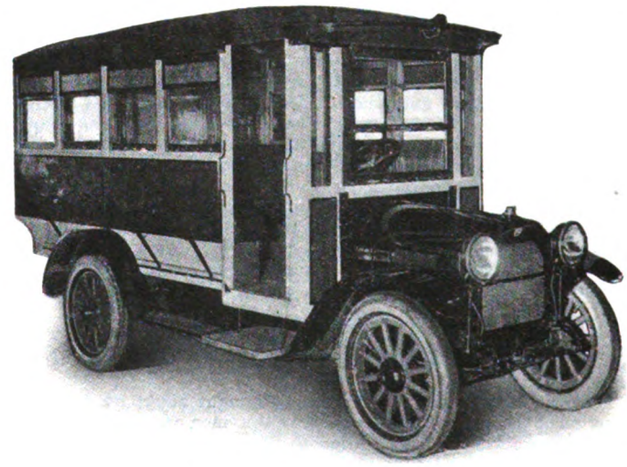
Mr. Rolls, a driver, suggested there were practically "stops" already for omnibuses, and in the suburbs he believed compulsory stops would answer very well.

Mr. Salmon (driver) said he was the man referred to who got the medal, but he was awarded it for two years' service, during three months of which he had been ill. He had been driving since 1908 and had never had an accident.

Mr. Howell having spoken, a cordial vote of thanks was passed to Mr. Winter-Gray for his address, and to Mr. Blain for presiding, proposed by Mr. Murray (Walthamstow), seconded by Mr. A. Gowans Whyte.

CLOSED CABS FOR OMNIBUSES.

In addition to the omnibus of the pay-as-you-enter type shown at an industrial motor vehicle exhibition in New York, and illustrated below, there were numerous other omnibuses exhibited in which closed cabs were a feature. Similar prominence was given to the closed cab body at a recent exhibition at Chicago. The closed cab is intended for winter driving, and it was to be seen in many different types. Some are designed so as to be removed in summer, and in these a new type of light top is fitted. It is



Pay-as-You-Enter Omnibus Exhibited in New York.

held that a closed cab enables a driver to do more and better work. The New York *Commercial Vehicle* affirms that the innovation is a war lesson. In France the drivers of American trucks were supplied with the best quality of rubber coats and rubber curtains hung in front of the cab to keep them dry and fairly warm. It is asserted that many of the men returning to the States will be dissatisfied in operating trucks unless they are provided with at least as good or better protection as they had while abroad.

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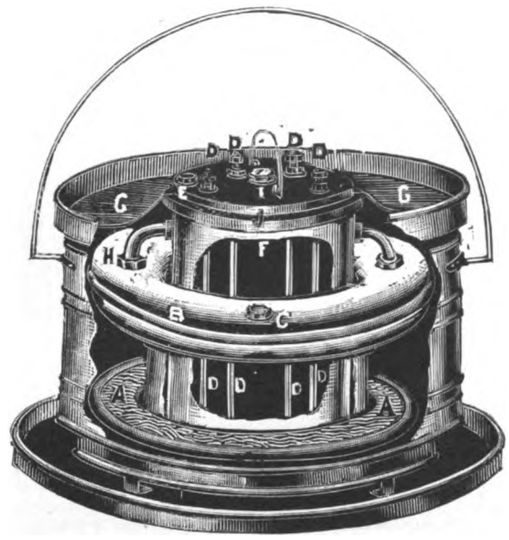
GABRIEL'S STEAM SPRAYER.

A Useful Disinfector for Public Vehicles.

The steam sprayer illustrated below, which is designed for disinfecting purposes, has been found specially suitable for use in tramway cars, omnibuses, and other public vehicles which, owing to being overcrowded at the present time, are great germ carriers, and should be disinfected once every day. The mode of disinfecting the cars is by placing the sprayer inside the car and closing all the doors and ventilators, or by placing the sprayer on the platform and attaching to one of the spraying tubes the flexible tube with nozzle, which is run through the keyhole or any other aperture into the car. The remaining three spraying tubes are fitted with blank caps.

The arrangement consists of a portable stand of wrought steel, in the centre of which is placed a round metal burner, A, filled with asbestos wool, and arranged to burn methylated spirit. Suspended over the burner is a round copper boiler or water jacket, B, in which



Gabriel's Steam Sprayer.

is placed the water to generate the steam. In the centre of this boiler is placed a metal vessel, F, in which is placed the liquid to be sprayed, and this vessel is connected to the boiler by a bent metal tube. Attached to the top of the vessel, and extending to the bottom, are placed metal tubes, D, and at the top of each is fixed a valve, I, with an adjustable cover to regulate the pressure. The valve has four very fine holes drilled in the bottom, and a single hole in the centre of each cap through which the steam and liquid are passed. The fitting is provided with a suitable spring safety valve, which allows any surplus steam to escape. When the steam is generated in the outer boiler, it passes through a tube into the centre boiler containing the fluid to be sprayed, and then up the four small holes in the valve chamber, and draws up the fluid and passes the same into the atmosphere in the form of a very fine spray. The sprayer is made in three sizes, and is manufactured by Messrs. Gabriel and Company, of 4 and 5, A.B. Row, Birmingham.

RAIL AND OMNIBUS FARE REVISIONS.

The increase in operating expenses brought about by the introduction of shorter working hours for railwaymen and certain sections of transport workers, in addition to the constantly increasing cost of materials necessary for maintenance, has entailed a revision of fares on the Underground Railways and London General Omnibuses. Certain changes took effect on March 27th. On April 6th certain fares on the District, Bakerloo, Piccadilly, Hampstead, Central London, and City and South London Railways were revised, and a revision in certain season ticket rates on all the Tube Railways will take place also at a later date.

Thames Valley Omnibus Service.—The British Automobile Traction Company have been granted licences for motor omnibuses to run from Reading to Henley and Marlow.

LEYTON'S ELECTRIC DUST VAN.

Seven Further Purchases Recommended.

In a report on the working, for the year 1918, of an electrically-propelled motor dust van, the Leyton Urban Council surveyor expresses the opinion that results had been even more satisfactory than for the half-year ended December 31, 1917, and fully justified the purchase of sufficient motor vans to collect the whole of the house refuse of the district. The average number of contractors' horse vehicles last year was 14 carts per day, and the saving of three carts per day by the use of motor vans was maintained throughout the year.

On the basis that the motor van is carrying out the work of three carts, the comparative cost is as follows:—

	£	s.	d.
Three days at £1 3s. 8d. per day	3	11	0
One filler's wages	0	9	7
Cost per day for horse carts	4	0	7

307 days at £4 0s. 7d. equals £1,236 19s. 1d.

The cost per day for motor vehicle for 12 months ending December 31, 1918, has worked out as follows:—

	£	s.	d.
Driver (including overtime)	0	12	8½
Two fillers (ditto)	0	19	1½
Electric current	0	4	0
Maintenance and repairs	0	4	0
Contingencies, say	0	1	0
	2	0	10
Less receipts	0	5	0
	1	15	10

307 days at £1 15s. 10d. equals £550.

	£	s.	d.
Annual cost of three horse carts	1,236	19	1
Annual cost of one motor van	550	0	0
	686	19	1
Less 12 per cent. depreciation (or repayment of loan), say	169	19	1
	517	0	0

The motor van is collecting house refuse from 13 miles of roads, or one-fifth of the total mileage, and from 4,000 houses, or one-sixth of the whole.

These figures, the surveyor states, bear out his previous report that seven vans should be provided to do the whole of the work of the district. Although the cost should be little more than that of six vans in full work without breakdown, for the sake of comparison it may be assumed seven vans with working expenses, including seven drivers and twelve fillers, together with maintenance and repairs amounting to £3,550, plus depreciation or repayment of capital spread over ten years, of say £1,180, against 16·8 horse-drawn carts at 23s. 8d. per day, and five additional fillers, or £6,840 per annum, with one motor van and driver in reserve for breakdown or emergencies or assistance with other work.

RUNNING COSTS OF A CAR.

An official of Southampton Corporation was furnished with a motor car in lieu of a horse and trap in June, 1913, at a cost of £267 12s. For the first two and a half years the running cost per mile, including petrol, lubricating oil, tires, repairs, and all other incidentals, including insurance, but excluding any sum for depreciation, varied from 2·36d. to 2·51d. The figures for 1916, 1917, and 1918 are given below.

	Miles Travelled.	Cost of Running.	Insurance.	Repairs and Hire.	Total.	Cost per Mile.
		£ s. d.	£ s. d.	£ s. d.	£ s. d.	d.
1916	5,155	37 7 3	12 7 6	4 12 9	54 7 6	2·53
1917	5,399	32 10 0	12 7 6	5 12 6	50 10 0	2·24
1918	4,501	37 5 6	12 7 6	37 13 6	87 6 6	4·65
Total for 3 years to Dec. 31, 1918	15,055	£107 2 9	£37 2 6	£47 18 9	£192 4 0	3·06

The large sum for hiring in 1918 was due to the length of time taken in getting a broken part replaced.

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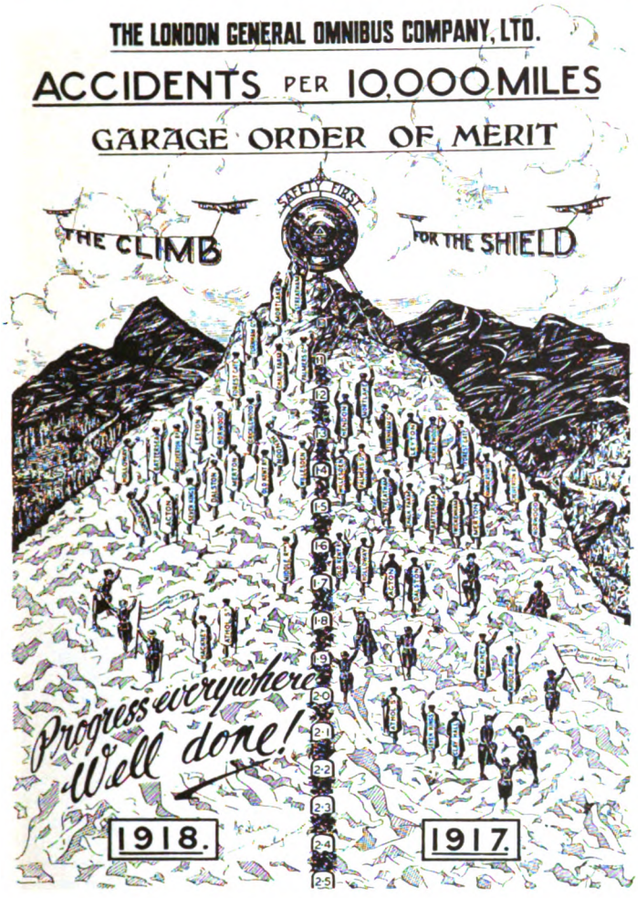
MOTOR TRAFFIC

FREEDOM FROM ACCIDENT SHIELD.

To stimulate their staff to greater efforts in the direction of freedom from accidents, it is the practice of the London General Omnibus Company to award a shield each year to the garage whose drivers have had the fewest number of accidents per 10,000 miles



run. For the year 1918, although closely contested by Mortlake and Turnham Green, the shield has been won by Streatham. The continued improvement in the direction of safety by all garages will be apparent when a comparison of the 1918 figures against each garage is made with the corresponding figures for 1917, as shown in the appended cartoon.

ROAD BOARD OFFICERS.

Mr. Manville, in the House of Commons, asked the Prime Minister whether Sir George Gibb, previously general manager of the North Eastern Railway Company, has resigned the chairmanship of the Road Board in order to return to the service of that company, and whether it was the intention of the Government to appoint to the chairmanship of the Board someone who had practical knowledge of the problems of roads and road traffic. Mr. Baldwin, in reply, said that Sir George Gibb was continuing to act as chairman of the Road Board until a permanent arrangement could be decided upon as a result of the consideration by Parliament of the Bill for the establishment of the Ministry of Ways and Communications.

It was stated in the House of Commons subsequently that Brigadier-General Maybury, who has been acting as Director of Roads in France under the War Office, resumed his duties as engineer and Secretary of the Road Board on February 27. Subject to the approval of the Board and of the Treasury where necessary, General Maybury has full authority to assist local authorities to carry out the programme of road and bridge work approved by the War Cabinet.

MOTOR VEHICLES FOR MUNICIPALITIES.

Luton Council contemplate obtaining an ambulance.

Bolton Corporation have purchased a motor wagon with tipping body.

Halifax Tramway Committee propose to obtain a motor tower wagon.

Harrogate Council are acquiring an Austin lorry at an estimated cost of £865.

Tunbridge Wells Council have agreed to purchase two motor lorries for refuse collection.

Peterhead Council have been presented with an ambulance by the Aberdeen Red Cross Society.

Walthamstow Council have received delivery of a steam wagon from Messrs. Clayton and Shuttleworth.

Johannesburg Municipal Council have purchased a 25-h.p. "Reo" four-cylinder ambulance for £615.

Leyton Urban Council have decided that not more than three War Office motor vehicles shall be acquired.

Knaresborough Rural Council have appointed a committee to go into the question of mechanical haulage.

Winchcombe Rural Council have asked a committee to report on the question of obtaining a steam tractor and trucks.

Londonderry Corporation have ordered six single-deck motor omnibuses from the Associated Equipment Company, Ltd.

Leamington Council have authorised the surveyor to purchase motor vehicles or horses as he deems fit, to the value of £1,000.

Pershore Council are considering the respective claims of petrol and steam wagons for service in their rural district. Reports have been called for.

Plymouth Corporation are to receive a recommendation from a sub-committee of the Hospital Committee with regard to purchasing a steam wagon.

The Swansea Health Committee have decided to provide the superintendent and four foremen with motor bicycles, so that they can more effectively supervise scavenging work.

Heston and Isleworth Council have placed orders as follows:—Five-ton Sentinel tipping wagon, £1,295; 3-ton Mann's tipping wagon, £985; and one 5-ton Clayton tipping wagon, £1,105.

Lewisham Guardians are inquiring as to the purchase of a motor ambulance. They were offered a special constabulary ambulance for £350, but concluded it would be advisable to purchase a new vehicle.

Romford Rural Council have purchased a 3½-ton Straker-Squire motor lorry for £550, which the chairman of the Highways Committee and the surveyor selected on a visit to Richborough, the train ferry port.

Portsmouth Corporation have obtained a reduction from £1,377 to £1,277 in the price of a rubber-tired steam tipping wagon, to be purchased from Messrs. Foden, Limited. In November, 1916, Messrs. Foden's tender was £800.

Newton Urban Council, after considering their surveyor's report of his inspection of the motor vehicles belonging to Warrington, have decided to defer the question of purchasing motors until the Government release some of their war stock.

The Central Garage Committee of Glasgow Corporation suggest acceptance of the offer of Messrs. Claud Hamilton, Limited, to supply three Crossley cars, 20-25 h.p., and three Swift cars, 17 h.p., delivery to be completed by the end of June.

STEAM LORRIES FOR ROAD WORK.

Inquiries by Ministry of Munitions.

Reporting to Warwickshire County Council, the surveyor states that in view of the increasing difficulty of getting road material hauled, and of the great increase of price for all team work, it is advisable to acquire a number of motor lorries. The average cost for the delivery of the material on the roads for the twenty years from 1894-1914 was 8d. per ton per mile. Since the commencement of the war the average price has been as follows:—1915, 9·2d.; 1916, 10·6d.; 1917, 13·1d.; 1918, 16·2d. The Road Board had been requested by the Ministry of Munitions to ascertain what plant is likely to be required by local authorities to carry out the road programme for 1919-20. He recommends that applications be made for ten steam rubber-tired lorries to carry four tons each, and that a similar number of trailing wagons be also acquired.

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MOTOR TRAFFIC

MOTOR TRAFFIC NOTES.

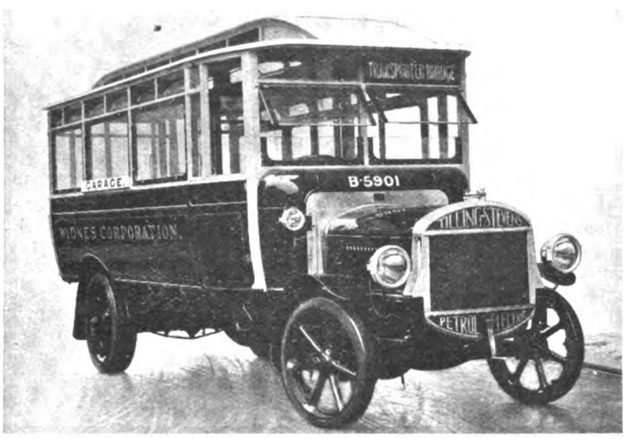
PETROL FOR LIVERPOOL OMNIBUSES.—Liverpool Corporation Tramways Committee have placed an order for a twenty-thousand gallon petrol installation on the hydraulic system.

OMNIBUS SERVICE FOR A VILLAGE.—Amersham Rural Council have given permission to Messrs. Miles and Company to run a motor omnibus between Amersham, Chesham, and Wycombe.

BIRMINGHAM-WORCESTER OMNIBUS FACILITIES.—With the situation as regards labour and materials becoming easier, the omnibus service between Birmingham and Worcester has been increased to a half hourly one.

ALCOHOL FUEL INVESTIGATION.—Under the auspices of the Royal A.C and the Commercial Motor Users' Association, a programme of research is to be conducted at Manchester University into the behaviour of the vapour of alcohol and mixtures of alcohol with benzol and petrol, etc.

OMNIBUSES IN MELBOURNE.—Sanction has been given to a Sydney firm for running a service of motor omnibuses in Melbourne. The three vehicles already in service were driven from Sydney to Melbourne, a distance of 580 miles, and ten more are to be added. The omnibuses, which are of the single-deck type, are of American manufacture.



Tilling-Stevens Single-Deck Omnibus for Widnes Corporation.

PETROL FOR MOTOR SWEEPERS.—To simplify the procedure entailed in applying to the Customs and Excise for the repayment of one-half of the duty charged for petrol used in the sweeping machine belonging to Islington Borough Council, the department suggest that the Mayor and two other members should enter into a bond to ensure the proper use of the spirit.

TARLAND-ABOYNE MOTOR SERVICE.—A motor service for goods and passengers between Tarland and the Howe of Cromar is projected. At a public meeting it was decided to ask the East of Scotland Public House Trust, Limited, the present mail carriers, to commence a motor service. A committee was also appointed to take steps to secure a motor service between Aboyne and Tarland.

THE SUPER-TAX ON MOTOR SPIRIT.—In reply to representations by the Automobile Association in regard to the war super-tax on motor spirit, the Secretary of the Treasury states that their lordships have no power to waive the statutory requirements of the Finance Act, 1916, and that they are unable to deal with the matter in advance of the general consideration of the Budget requirements of the year.

NOTTS COUNTY COUNCIL AND RURAL TRANSPORT.—A special committee of the Notts County Council, after considering the subject of rural development, have expressed the hope that it will be found possible to continue the road transport organisation through the local authorities after the war, and that liberal grants should be made out of the National Exchequer for the reconstruction and strengthening of highways.

PROCEEDS OF THE WAR TAX ON PETROL.—Up to February last the motor spirit licence duty had brought in £71,859 to the Petrol Control Department. The staff in the employ of the department numbered 438 persons, whose salaries amounted to £3,993, but on March 14 the staff had been reduced to 382. The Royal A.C. intend to make an effort to secure the removal of the tax of 6d. per gallon when the new Budget is introduced.

RUBBER PAVING FOR ROADWAYS.—At the suggestion of Rubber Roadways, Limited, Mr. A. Harrison, borough engineer of Southwark, has obtained sanction from the council to continue an experiment of rubber paving for roadways, which was tried on a small scale a few years ago. An area of 400 square yards is to be paved with patent rubber blocks made from a composition similar to that used for solid-tired motor vehicles.

SUITABLE ROADS FOR OMNIBUSES.—A sub-committee of Wakefield Corporation have interviewed the general manager of the Yorkshire (West Riding) Electric Tramways Company with regard to providing either a tramway or omnibus service to Alverthorpe and Flanshaw. The committee reported that the present cost of construction rendered tramways prohibitive. If the roads could be made suitable the company would run omnibuses at their own risk.

AUCTION SALES OF SERVICE VEHICLES.—Under the auspices of the Disposal Board of the Ministry of Munitions, a large number of army motor cars and lorries were sold by auction during March in the Gilbey Hall of the Agricultural Hall, London. Full opportunity was afforded to obtain vehicles in single lots, and good prices were realised. Sales are to be held in various districts. Mr. W. Wolsey, jun., has been added to the Advisory Committee to the Disposal Board.

LANCASHIRE COUNTY COUNCIL'S TERMS FOR OMNIBUSES.—A payment of 2d. per omnibus mile on main roads, and an initial fee of a guinea per annum for each vehicle, are the terms upon which the Lancashire County Council have offered to sanction a motor omnibus service proposed by Mr. R. Roberts, of Widnes. The Council propose that these terms shall stand for five years, and they make the offer "in accordance with the provisions of the Local Government (Emergency Provisions) Act."

MESSRS. TILLING-STEVENS, in common with manufacturers possessing well-equipped works, were engaged almost entirely upon Government ordnance work. Since the cessation of hostilities however, they have made a rapid change over to automobile construction, and, being fortunately in possession of a fair stock of raw materials, are now able to concentrate upon the reduction of their waiting list. The illustration on this page shows a recent delivery of a single-deck omnibus, which is one of a number supplied to the Widnes Corporation. The chassis is the Tilling-Stevens standard 3-4 ton petrol-electric machine.

FRENCH CABS FOR LONDON.—The Home Secretary, replying to a question in the House of Commons, said that the present shortage of taxi-cabs was due to the scarcity of material and labour. As material became available, more and more cabs would be overhauled and put in service, but the question of licensing other types approximately suitable was under consideration. Sir P. Goff, having observed that several French firms were ready and willing to supply vehicles at once as soon as the Government prohibition was lifted and the duty taken off, Mr. Shortt said it was a question whether such vehicles were fit for the traffic of the London streets.

OMNIBUSES FOR EDINBURGH.—In his report to Edinburgh Tramways Committee, recommending the electrification of the cable tramways, Mr. R. Stuart Pilcher, general manager, urged that "it was desirable for the city to obtain powers to operate motor omnibuses in conjunction with the tramway system outside the city boundaries. There will be a distinct scope and promising field for the operation of motor vehicles. In addition to the temporary services over proposed extensions of the tramways, motor omnibuses would be useful to supplement the existing services at certain points; they would also be useful in cases of breakdown of portions of the cable system and for special purposes." The Corporation have since decided to purchase 15 omnibuses.

RUBBER FOR CHEAP MAINTENANCE.

Messrs. Leyland Motors (1914), Limited, have informed Westminster City Council that they find difficulty in obtaining steel tires for the front wheels of the Council's wagons on account of the general adoption of rubber tires, and offer to provide suitable front axles and wheels for the reception of rubber tires for four wagons which are maintained by them, the Council providing the rubber tires. The effect of rubber tires will be, the company state, to reduce the wear and tear of the motors, and consequently to reduce the work of maintenance under the contract. Moreover, when the contract was extended for a year recently the maintenance charge was increased from £55 to £100 per wagon per annum. In these circumstances the Works Committee have informed Messrs. Leyland Motors that they would recommend acceptance of their offer if they would provide the first sets of rubber tires as well as the axles and wheels. This the company have agreed to do, and the tires will be, it is understood, of the Shrewsbury and Challiner make.

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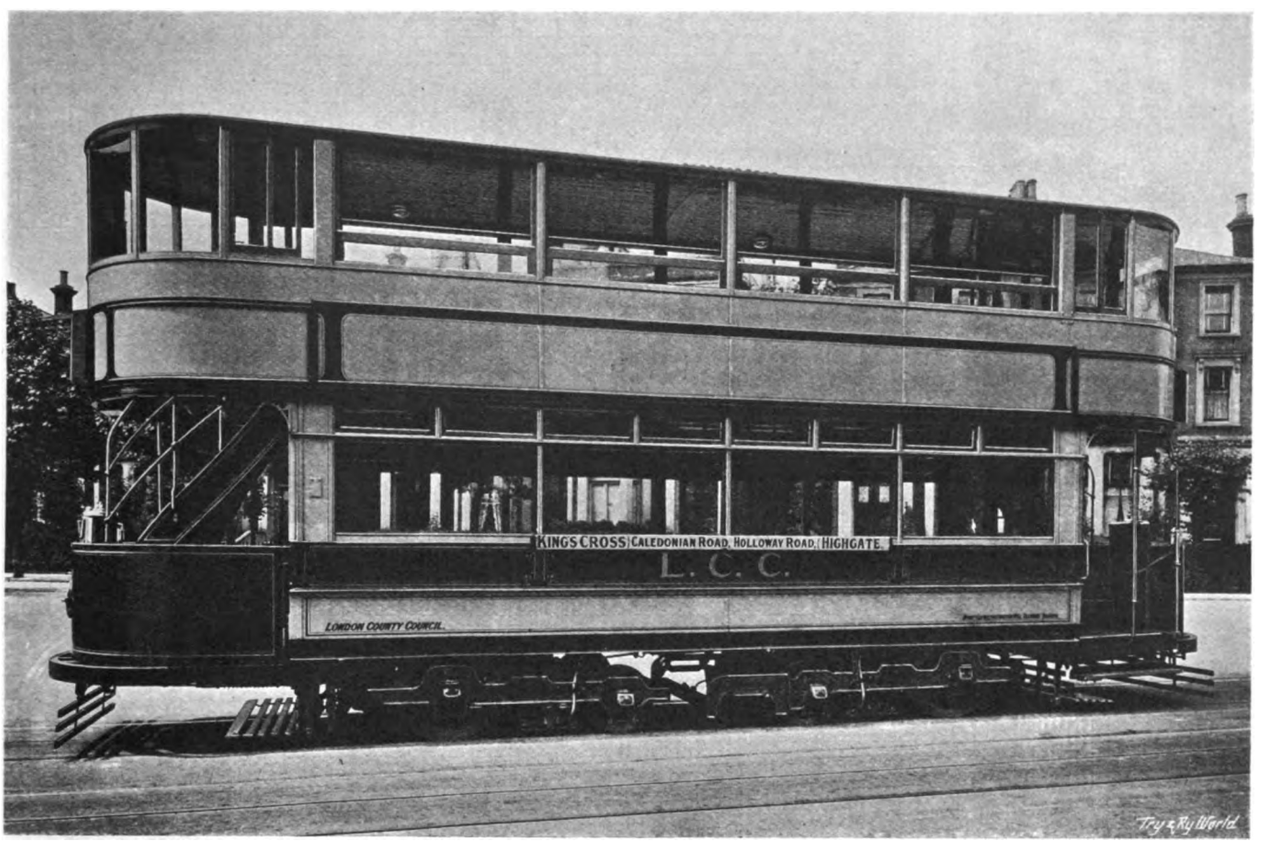
THE Tramway & Railway World
WITH MOTOR TRAFFIC SECTION

Founded 1892. LONDON, MAY 15, 1919. VOL. XLV.

LONDON COUNTY COUNCIL'S STANDARD TRAMWAY CAR.

The rolling stock of the London County Council Tramways has been obtained under different contracts executed at intervals from the time the first lines were reconstructed for electric traction in 1902-3 down to 1910. In consequence of this, and of the changes suggested by experience, several types of cars are now in use, but the greater number are of the London County Council standard type, which is shown in the accompanying illustrations. These cars have been built to the designs and specifications of Mr. A. L. C. Fell, general manager, and they were specially constructed to meet the traffic conditions in London. In reply to a question at a recent meeting of the Council by Mr. J. D. Gilbert, M.P., asking whether the present standard car was the most suitable type, Mr. W. J. Squires, chairman of the Highways Committee, replied that the present type had been chosen after careful study of the cars used in other cities, and in view of the traffic conditions in the Metropolis it was still considered the best type. This is a striking testimony to the care which was devoted to the determination of the standard type some years ago, and we think it is the general opinion that the type is on the whole well adapted to meet the exacting conditions under which the County Council have to run their cars. Throughout the whole London police district the tramway authorities have to observe the regulations of the Commissioner of the Metropolitan Police, which are more stringent than the regulations elsewhere.



The London County Council Standard Bogie Car.

It was finally decided that a double bogie type of car, with an enclosed top deck extending the full length of the roof, was the most suitable type. In the case of London, the question of obtaining the largest possible seating capacity in a car in proportion to its length is of very great importance. The Metropolitan police authorities in normal times, under the Police Carriage Act, refuse to allow any passengers on a car in excess of the number for whom seats are provided. After devoting considerable study to the question, it was found possible to construct a car measuring

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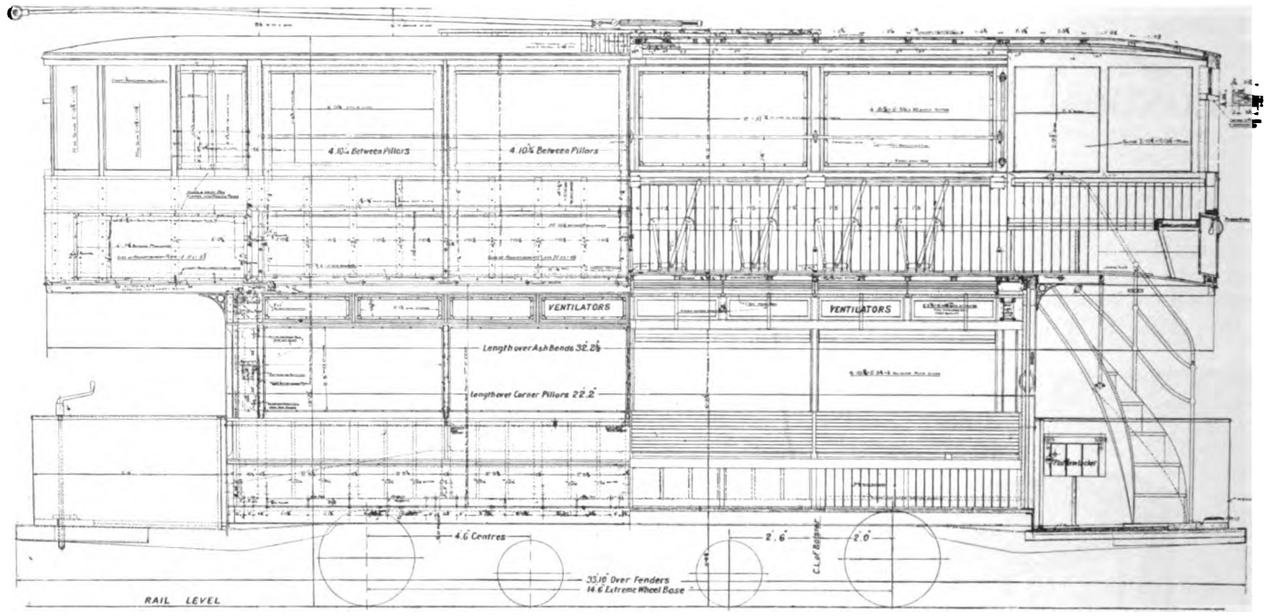
33 ft. 10 in. over the fenders, which accommodates 78 passengers, an increase of 12 passengers over the number provided for in the first cars constructed by the Council, the seats for the additional passengers being obtained by utilising the space above the staircase opening on the upper deck. Another condition which gave rise to some difficulty was that the space available under certain railway bridges which cross some of the tramway routes made it essential that the over-all height of the cars should be kept to a minimum.

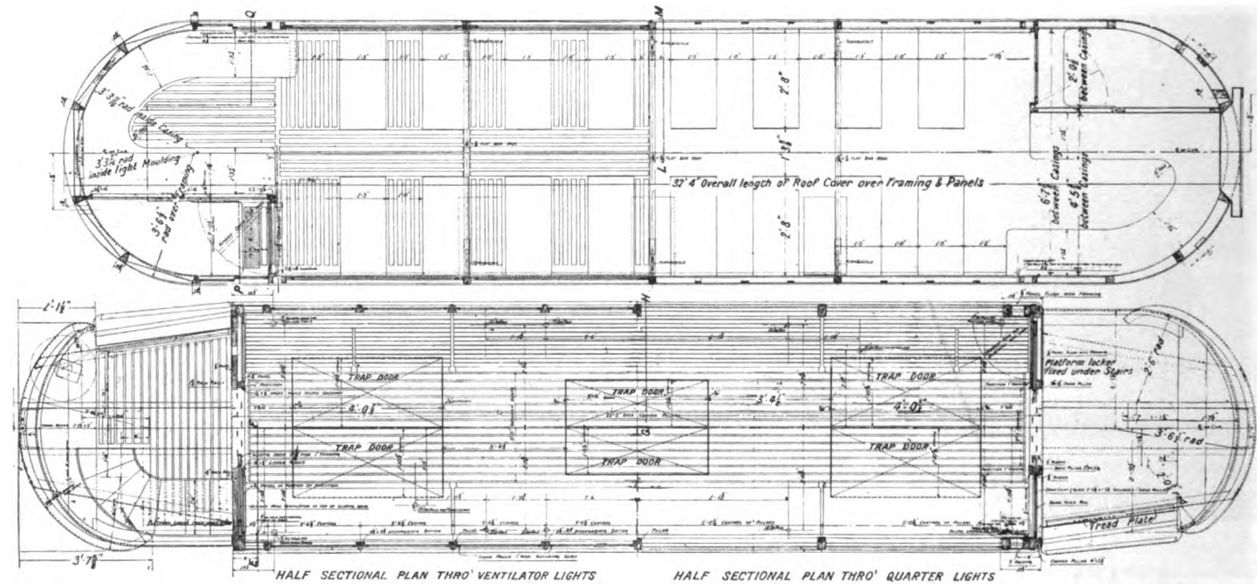
stress likely to be placed upon it. Stiffness is obtained transversely by suitable pressed steel brackets joining the transverse members of the underframe to the trussed plates and the main framing of the car body.

The principal dimensions of the standard car are as follows :—

Length over fender	33 ft. 10 in.
Length of body outside	22 ft. 2 in.
Width over guard rails	6 ft. 10 in.
Width outside over roof	7 ft. 2 in.



Elevation and Half Section of Standard Car.



Plans of Upper and Lower Decks of Standard Car.

In the construction of the standard car special attention was given to obtaining stability and strength to resist distortion, in view of the heavy mileages run and the loads to be carried. With this end in view, the underframe is constructed throughout of rolled and pressed steel members, and the tendency of the body to deflect at the ends is resisted by means of a steel plate 2 ft. deep by ⅜ in. in thickness, strongly rivetted to each of the channel steel sole bars of the underframe. This plate extends the full length of the car body, and is calculated to withstand the maximum

Height inside at centre from floor to under side of roof (head room)	6 ft. 2¾ in.
Height from floor to under side of roof cover (upper saloon)	6 ft. 2 in.

Destination indicators, mounted in teak weather-proof cases, are provided at each end of the car, and are placed just above the lower roof. The names are shown in white on dark-coloured geared roller blinds. Each car also carries in the end window of the upper saloon an illuminated service number to indicate the route on which it is travelling at the time. The life-

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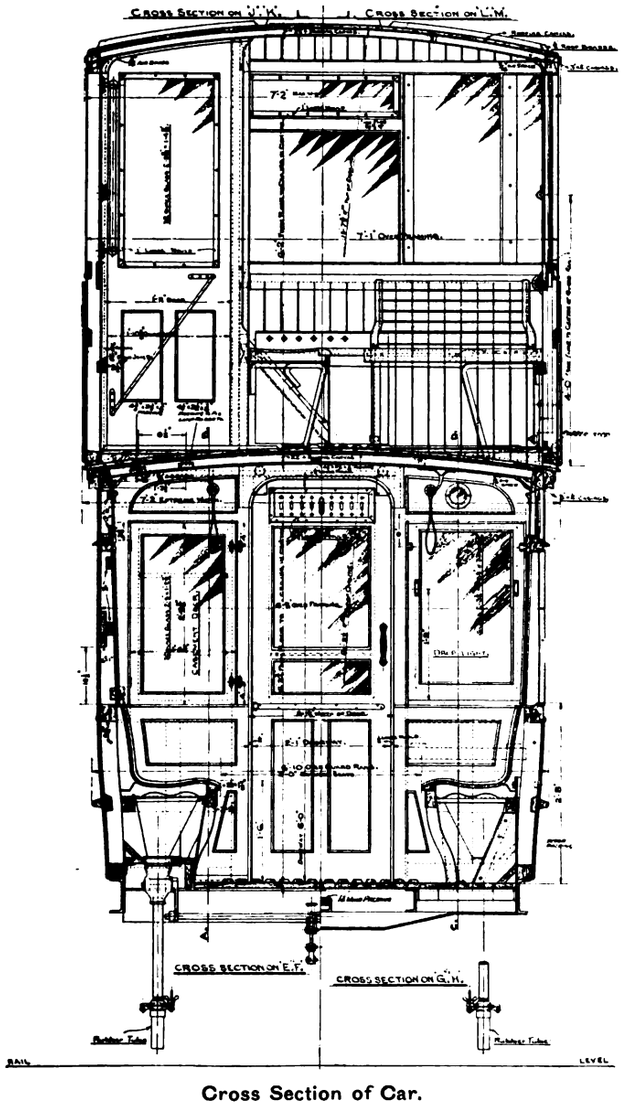
guards are of the swinging gate and tray pattern. The other fittings include at each end sand hoppers, a dash light, a foot gong, mechanical signal bells, a platform locker, lifting step, and hinged canopy boards bearing the word "Full" in large letters, which are exhibited when no more passengers can be taken. Every car carries an oak tool-box containing the following tools:—One feeder pillar key, one jack of 5 tons capacity, one 2-lb. hammer, one pair of hatch lifters, one screwdriver, one pair of pliers, one pair of india-rubber gloves, ash strips for putting ploughs in at live hatch, one adjustable spanner, one chisel, one shackle, one tin disinfectant powder, one plough lifting rope, and one wood block.

The following tools are also carried :—One crowbar with top end made to fit the jack, one point lever, one flexible steel tow-rope and hooks to which are attached by split link and chain two standard draw-pins.

The cars are lighted by circuits of 125 volt, 25-watt metallic filament lamps, with five lamps in series



Cross Section of Car.

arranged as follows :—Inside, 6; top deck, 6; head lights, 2; canopy lights, 2; destination indicators, 6; service Nos., 2; police traffic lights, 4.

Externally the cars are finished in Midland red and pale yellow, the initials "L.C.C." in large size being placed at the side of the car, and the car number on the dash plate.

The cars are mounted on bogie trucks of the maximum traction type with swing bolsters. These trucks were specially designed, and have been standardised

End View of Standard Car.

on the Council's system. The following are the dimensions :—

Wheel base of truck	4 ft. 6 in.
Distance between pivotal centres	13 ft. 4 in.
Minimum radius of curve to be negotiated	40 ft. 0 in.
Diameter of driving wheel on tread ...	2 ft 7¾ in.
Diameter of trailing wheels	1 ft. 9¾ in.
Diameter of driving axle	0 ft. 5 in.
Diameter of trailing axle	0 ft. 3¾ in.
Height from rail to top of side bearers ...	2 ft. 2⅝ in.
Distance of centre of pivotal point from centre of driving axle	0 ft. 7 in.
Maximum width over axle boxes	6 ft. 10 in.

One truck on each car supports the plough carrier, which consists of two side brackets bolted to the truck and two transverse channels in which the plough is free to slide. Steel-tired wheels are used.

The motors, of which one is mounted on each truck, are capable of accelerating a double-deck car, weighing approximately 18 tons when loaded, at the rate of 2 ft. per second on the level up to a speed of twelve miles an hour. Each motor is capable of developing an effective tractive effort on the periphery of the driving wheels of 1,300 lb. at the rate of twelve miles per hour. In addition to their traction use, the motors operate the Westinghouse electro-magnetic brakes, which are used as service brakes.

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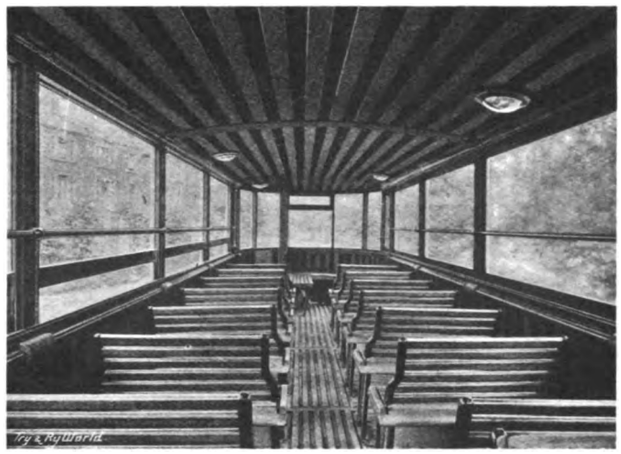
There are now a number of places on the tramway system where the cars run from the conduit to the overhead system, and many of the cars are provided with trolley booms and wheels.

In addition to the standard bogie car, the Council possesses a number of four-wheel double-deck cars of an earlier type, and 50 steel single-deck cars which are run on the service through the tramway subway, which affords connection between the northern



L.C.C. Standard Car—Upper Saloon.

and southern tramways. These cars are entirely built of steel. There are also a number of trailer cars.

The total rolling stock of the County Council now consists of the following :—

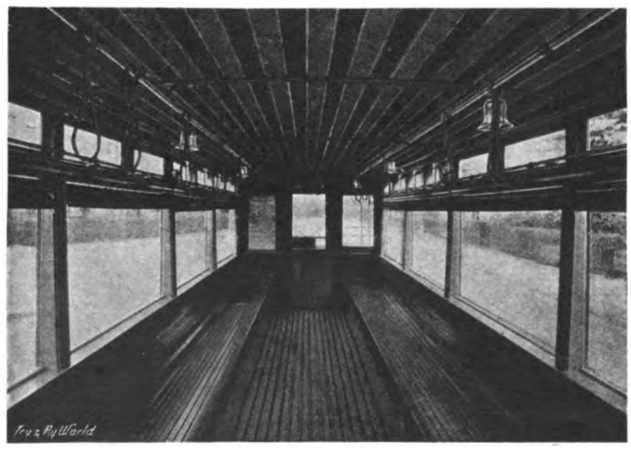
Cars.

Bogie cars	1,375
Single truck cars	242
Steel subway cars	50
Trailer cars	158

Other Tramway Rolling Stock.

Stores transport vans (electric)	8
Water vans (electric)	4
Rail grinder (petrol)	1

The car bodies have been built for the Council at various times by Dick, Kerr and Company, Limited,



L.C.C. Standard Car—Lower Saloon.

the Brush Electrical Engineering Company, Limited, Hurst, Nelson and Company, Limited, and Mountain and Gibson. The electrical equipments have been provided by Dick, Kerr and Company, Limited, the British Westinghouse Electric and Manufacturing Company, Limited, and the Brush Electrical Engineering Company, Limited.

TOOLS FOR PERMANENT WAY MAINTENANCE OF ELECTRIC RAILWAYS.

By E. Capone.

The work involved in carrying through the electrification of railway track generally comes under the scope of a contractor who has a staff at his disposal experienced in this section of work. As the work draws near completion the engineers responsible for carrying it out prepare to hand their work over, and then the question of maintenance arises. Upkeep does not involve the employment of large numbers of men, or the use of great quantities of material; but it calls for careful organisation of an experienced staff (generally selected from men who have been employed during the construction), the proper location of stores, and the supply of requisite maintenance tools. In this the unexpected has always to be kept in mind, and such arrangements made that men, material, and tools can be readily found, and, what is more, brought quickly to any part of the line day or night. This is the principal object for which the system of organisation should be instituted. Accidents are not exactly in the regular programme of a railway company, but the importance of being in a position to deal with such eventualities is a duty to the public, and one which rightly receives first consideration.

The question of dividing the duties and defining to what extent they should reach is open to adjustment, and the fact that two sections of work are involved causes some little difficulty, while efficiency depends so much on the co-operation of the two. It is clear that an absolute understanding must be arrived at, so that the duties of the respective sections are made as far as practical, distinct, thus eliminating any possible confusion or indecision in emergencies. The work of general maintenance, alterations, operating switchgear to enable work to be done, bond and track cable testing, insulator replacements, handling breakdown gangs, and such like work involves overlapping between the electrical and track departments, and it often happens that the traffic section has interests in the proceedings. It is generally admitted that the electrical side should have control of their section. Linking up or operating section switchgear, and the electrical testing, should be in their hands, and no countermanding orders should be possible. Yet the needs of the track engineer or traffic section will often call for rapid isolation of lines, and in cases of such emergency it must be possible to operate without the delays attendant on consulting a second party. The exact line of demarcation is subject to agreement, but the leading points can be roughly stated. First the electrical side should have control of sub-stations and cables up to the distributing cabins. From this point they arrange the method of feeding, control the arrangement of sectioning switches, and decide the method of feeding the lines. The electrical department also have the upkeep and testing of LT cables up to the conductor rail. In addition, the testing of bonded joints, conductivity of rail, and insulation can be considered a part of the electrical work.

The permanent way engineer has to act under instructions from the electrical side in so far that a list of faulty joints is handed to him for rebonding. In the case of cable faults or extensions, he finds the labour and lays the cable, leaving the jointing to the electrical engineer. In the carrying out of general maintenance, such as replacing insulators, wood protection, and gauging rail, special tools are used, and it is possible to manage it without putting the conductor rail out

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of commission ; but when rebonding or making adjustment of ramps and joints, etc., it is necessary to isolate the section. In this case, to avoid interfering with traffic or trespassing on the electrical arrangements, the maintenance engineer applies to the signal cabin or section switch operator as to traffic conditions, and with the operator's sanction he gets the section switched off. He then puts his tab on the switches opened, the tab being kept in that position as an indication why and by whom it is opened. The maintenance engineer is responsible for the switches until he reclaims his tab, at which time he closes switches as he found them. Occasions arise where the switch is open on account of other work, and already has a tab affixed, but since he may also require it open, he adds his tab to the one already on, and thus for the time holds control of the line.

On most lines it is possible to disconnect short lengths by unbolting the bonds from the feeder terminals, and just bending the former (which are very flexible) back from the cable. This is very convenient and is often resorted to when the work has to be done some distance away from points of control. Of course in certain cases the time will have to be previously arranged, and telephone or signalling employed to expedite matters, but the system is the same, and the work is done without any delay or formality.

The equipment of tools necessary when working on a live rail may be detailed. A portable box of testing lamps (Fig. 1) at each distributing cabin is indispensable, as the operator has no indication whether a section is dead or alive, and one of the first rules on connecting or disconnecting is to make sure that the rail is dead or alive, as the case may be. Rails are often inter-connected and generally fed from both ends ; hence to cut a section out depends on the work of more than one person, and it is advisable to test before and after working. Each gang should be supplied with a box of lamps for the same reason. It will be noted that there are two sets of lamps provided, so that the failure of a lamp is of no serious consequence. When, as often happens, the distance between distributing points is of some length, a portable telephone, with leads and a long bamboo rod for reaching and tapping telephone wires, is of great assistance in procuring material or conveying instructions as to traffic conditions. The points on the box of lamps act as legs, and make a better contact than flat strips of metal.

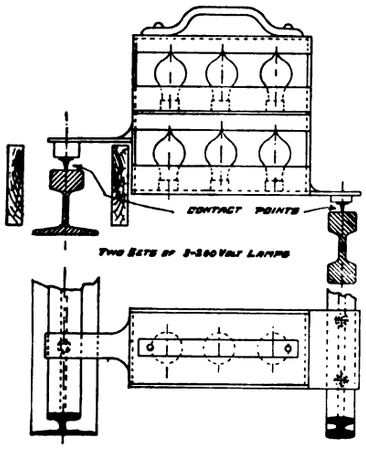

Fig. 1.—Portable Testing Lamps.

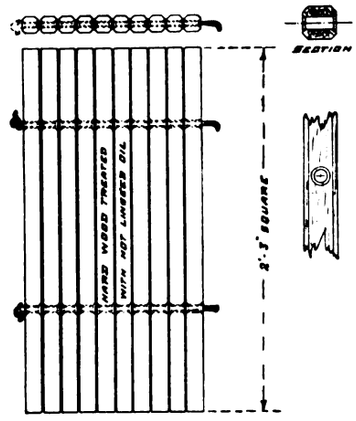

Fig. 2.—Wooden Mat.

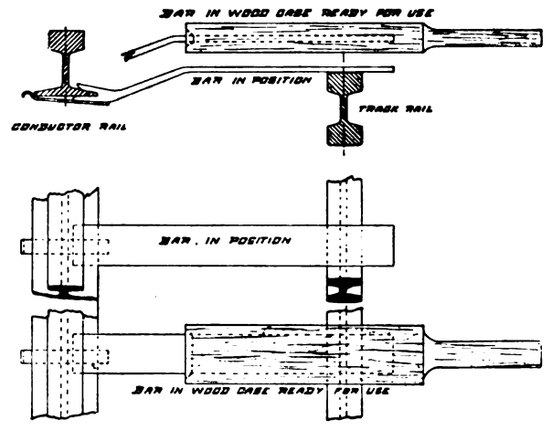

Fig. 3.—Shorting Bar in Wooden Case.

A wooden mat is made in the form shown (Fig. 2), so as to obtain flexibility, and take up the irregularities of the ground ; it has to be used on the ballast, and under those conditions is found to give a good foothold. The construction of the mat allows it to be coiled up into a small compass.

The shorting bar (Fig. 3) is only used in cases of emergency, but is essential where work is being done. It is usually considered to be part of the equipment of the signal cabin or distribution box, because an operator is always in charge, and is the first to learn of an accident within his locality. A gang working at a distance, if provided with a shorting bar, can quickly cause a disconnection in case of an accident. The shape of the bar is such that it can be quickly put between the live rail and track, and so blow circuit breakers ; it is kept in the wooden case ready for use. The case acts as an insulator whilst contact is being

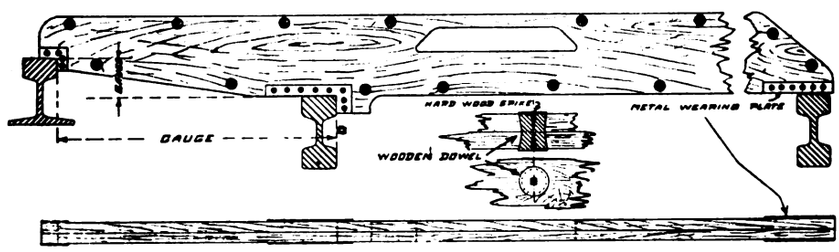

Fig. 4.—Insulated Conductor Gauge.

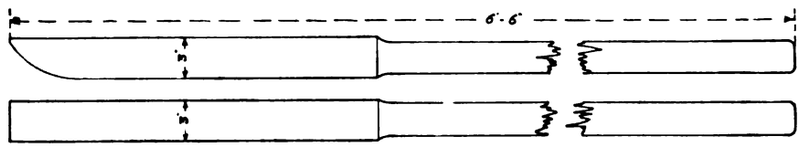

Fig. 6. - Wooden Lever.

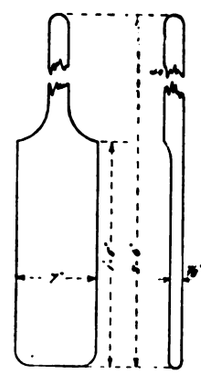

Fig. 5.—Wooden Spade.

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made, the bar dropping on to the track rail when the case is pulled away by the handle.

Next we have the insulated conductor gauge, which is serviceable for testing the position of the conductor rail whilst the current is on (Fig. 4). It is made in two pieces dowelled together with wooden pegs—there are no metal parts. With the exception of the gauge or wearing plates, the whole gauge is coated with varnish.

Wooden spade (Fig. 5) and wooden lever (Fig. 6) are two valuable tools made of hardwood treated with hot linseed oil; this treatment was found advisable, as it afforded good insulation in wet weather. In the case of spanners it was found best to coat the metal handles with varnish, and slide them into sleeves of wood with blank ends, thus protecting the ends of the handles. The wooden sleeves were kept on by the varnish drying, but to make quite sure small hardwood pins were put through the iron handle and wooden sleeve, and the whole taped over. In cases where damage occurs to LT underground cables, when delay might possibly arise in putting it right, an india-rubber jumper cable of about ·75 square inches is used, the ends soldered into G.M. clamps, which fit on the foot of the conductor rail, and are bolted up; the advantage of this is considerable when the time element is of importance. These lengths of jumper cable are used for alterations, temporary connections, or when work is left owing to bad weather, and are indispensable.

Location and distribution of stores for the supply of material and tools are naturally dependent on local conditions, but the position of the principal stores is not of so much importance in cases of emergency as the auxiliary supply depots. Supplies are usually required over a large area, and both material and tools must depend on local stores for a direct supply, and should not have to wait for deliveries from the principal centre. At each of the auxiliary depots a minimum supply of all requisites in both material and tools should be kept, and all withdrawals replaced from the main stores.

In choosing the position of an auxiliary stores it is advisable to have it near or in conjunction with the sub-stations, works, or offices, that may be adjacent to the line. For intermediate positions, the largest or busiest centres would naturally be selected. The means of telephonic communication is of importance, and should be installed if not otherwise readily accessible. Lengths of conductor rail are not easily carried, and often inconvenient to store, but to obviate trouble a good practice is to distribute equi-distant along the track small lots of rail, fishplates, and one or two spare ramps, thus providing an accessible supply at any point, and saving cartage. This method has been adopted and has been found very advantageous, the only precaution necessary being to have all the material painted and placed on timber or stones to prevent deterioration. At certain of the depots it is advisable to have a hand trolley for the rapid conveyance of men, tools, and material along the line, so that a gang is independent, and no delay is incurred waiting for trains. The necessary traffic signals, flags, and lamps should always be supplied, and the use of hand-propelled trolleys restricted so as to conform with traffic regulations. Under certain conditions a representative of the traffic section has to be in charge. On large systems, separate wagons could be kept provided with all essential gear and attached to the breakdown train. No hard and fast rule can be given, as conditions vary so much. Wood protection should be stored in complete standard lengths actually ready for use, and as such should be sent out from the works, so as to simplify the work of erection, and consequently reduce the time that would otherwise be taken in fitting pieces together on the site.

Besides the usual equipment of track implements, the insulated tools considered advisable to be kept in readiness at the auxiliary depots are insulated gauges, testing lamps, wood levers, wood shovels, insulated mats, shorting bars and cases, jumper cables with clamps, and a complete set of insulated spanners.

The amount of material to be retained at the auxiliary depots need only be sufficient to meet the average requirements for repairs on that section of the line. In the case of the main stores a standard could be fixed for sufficient material for the complete equipment of 1-50th of the total track electrified, but in the case of bonds and insulators, 1-30th of the total length of line will be necessary as the calls for these two items are heaviest, and it is advisable to keep a correspondingly large stock.

BELGIAN RAILWAY ELECTRIFICATION.

A Royal Commission has been appointed to examine the question of the electrification of Belgian Railways, and to submit proposals for the execution of the scheme. Before the armistice a Commission sat at Havre on the question of electrification of the railways. The *Board of Trade Journal* states that the work of this Commission was understood to be in an advanced stage last January, and a further conference was held towards the end of February to decide definitely whether or not any Belgian lines would be electrified.

The projected scheme is to electrify main trunk lines on the overhead trolley system. New carriages and motors would be supplied for the purpose, but trains would be so constructed as to be suitable for steam haulage over non-electrified lines. Carriages would be of the "coupé vento" bogie, metropolitan type, interconnecting, and would have two doors on either side. The object aimed at would be to use trains over scheduled distances, i e., trains would run backwards and forwards on such routes as Antwerp-Brussels, or Arlon-Ostend. Auxiliary lines might be electrified later. The idea is to use German railway material pending its replacement by new rolling stock.

A BILL TO RESTORE TRADE UNION CUSTOMS.

By the Munitions of War Act, 1915, the Ministry of Munitions was empowered to operate all engineering and other works under its control free from any restrictions which trade customs or rights imposed. According to the rules of the Amalgamated Society of Engineers, for example, only members of the society could be employed in the workshops. Other trade unions had similar rules, and workshop practices were regulated in numerous details, the ostensible object of all these restrictions being to conserve the interests of the workers normally engaged in the different industries affected. But while on the one hand the demands of the fighting forces had denuded the works of skilled men, on the other hand the needs of the army for supplies of munitions of all kinds, which only the engineering industries could supply, had enormously increased. In such circumstances, unskilled labour and women had to be called in, and everything that obstructed the most rapid production possible pushed aside. On the undertaking of Ministers that their rights and privileges would be restored after the war, the trades unions waived their claims, trade union rules were abrogated, and all restrictions upon output removed, women and girls being largely employed upon what had formerly been regarded as the work of skilled men.

On Tuesday, April 15, the Minister of Labour introduced into the House of Commons a Bill, entitled the "Restoration of Pre-War Practices Act, 1919," which is the fulfilment of the Ministerial pledge to the trade unions. The text of the Bill is short, but it seems to contain a good deal of material for prolonged controversy. The Bill mainly aims at providing that:—

(1) Owners of establishments wherein trade practices had been departed from during the war shall restore, or permit the restoration of such trade practices within a month of the date fixed by the Bill, and continue to maintain that condition for a year. (2) Into establishments employing workers to whom the trade practices apply, though formerly free from obligation to trade union rules, these practices will be introduced. (3) A majority of the employees shall decide whether or not the trade customs and practices shall be resumed (4) The owner of an establishment may object, and his objection is to be referred to a special tribunal (5) Refusal to comply with the provisions of the Bill involves a fine not exceeding £25 for each day or part of a day during which the offence continues

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AN AMERICAN VIEW OF GRADED ZONE FARES.

The native home of the tramway is in a rather confused state, and its guardians are looking for some way out of the trouble. Tramway managers in the United States are finding that the incomes of their undertakings do not balance expenditure, and as Wilkins Micawber testified from the depths of experience, that means misery. For a long time the cause of the trouble seemed difficult to locate. "Here," said the American tramway managers, in effect, "we have an ideal system for collecting cash; every passenger, no matter how short the distance he travels, must put down his nickel. No fuss, no trouble, no worry in collection—it is all so simple a child could collect the fares—and yet there is the deficit. What is wrong?"

In the days of their prosperity the tramway managers in New York, and beyond, had seen and smiled at the British method of charging and collecting fares. It had seemed to them much trouble for very little gain. Cent, two-cent, three-cent, four-cent, and so on tickets, with a conductor ranging through the car continually collecting coins and punching tickets, carrying a ticket bank as long as his forearm, struck our transatlantic friends as very nearly the acme of the ridiculous. They had escaped all that by the mere application of common sense at the start—charge the passenger five cents when he boards the car, and there is an end of it.

The success of British tramway undertakings, which carry enormous numbers of passengers at the equivalent of a two-cent fare, has latterly, however, begun to give them quite an air of respectability in the eyes of United States managers, and the zone system of charging fares shares in the enhanced repute. After all, for a thickly populated old country, zone fares were not altogether to be despised; but, of course, for a country like America the uniform charge was the more suitable. In that tolerant frame of mind, our Transatlantic friends arrived at 1914. Then a mysterious disease began to attack all grades and classes of tramway undertakings. Traffic increased, and receipts mounted up; but so also did expenditure, and while the increase in receipts slowed down, the additions to expenditure quickened pace. Indeed, it seemed as though things were working backwards, and that the more traffic there was on a system the worse were the financial results. Here was a mystery. At last it occurred to someone to ask if every passenger who paid a five-cent fare really defrayed the cost of his ride. Nobody knew; short-distance, middling-distance, and long-distance passengers were all lumped together, and the only thing that remained certain was that cars did not pay the expenses of their journeys. To avoid bankruptcy, some tramway undertakings have adopted the expedient of putting a limit to the five-cent journey, and making an additional charge for any distance beyond. Results have shown improvement, and therefore the question whether or not the zone fare system should be adopted in America has become a live topic over there.

The question whether graded zone fares or uniform all-over fares give the best financial results can only be settled satisfactorily by a reference to the actual operation and results of the two systems. America has had very little experience of zone fares. With a view to placing before its readers and the United States public the essential facts bearing on the latter method, the American *Electric Railway Journal* recently sent Mr. Walter Jackson to make exhaustive inquiries into the operation of the principal tramway systems of Great Britain, and to communicate the results of his investigations to the journal. Glasgow was Mr. Jackson's first objective, and in a series of three articles he has presented a clear picture and interesting study of the electric tramways and traffic conditions of that city, which American managers should find suggestive and helpful in the new conditions that they have to meet. The third article was published in the issue of March 29, and we are now able to review the series as a complete whole.

Preliminary, and apparently of primary importance from the transatlantic standpoint, is the question whether graded or zone fares tend to aggravate the evil of congestion in the more densely populated districts through which it runs. In a foreword contributed by Mr. James Dalrymple, general manager of Glasgow Corporation Tramways Department, he answers the question in the negative, arguing that congestion was a much worse evil before the advent of the tramways. Mr. Dalrymple points out that the tramways have tended to spread the population over a wider area, stimulated the desire to travel, and says that a noteworthy and unexpected effect of the introduction of halfpenny fares was the "filling up of the cars during the slack hours of the day." On the whole, Mr. Jackson inclines to the same view, but in a recent speech on the subject of halfpenny fares, Mr. Dalrymple indicates a change in his opinion, and admits that the halfpenny-fare passenger tends to crowd out the more effectively revenue-producing penny-fare passenger.

With the subject of congested areas and the relation of Glasgow housing problems to the tramway services, which Mr. Jackson ably describes, we are not at present concerned. It is when he deals with the short distance rider that we find his observations fresh and cognate to the subject under discussion. He says:—

> Practically all routes are double track, run through from one end of the system to the other, and are amply provided with cross-overs, both at the terminals and along the routes, to ensure the utmost flexibility of service. Because of the cultivation of the short rider, even in the outer districts, the turning back of non-tripper cars is not extensively employed except at or near the city limits, where there may be a sharp falling off in traffic. For instance, the Paisley-Uddingston line, which is 14½ miles long, has a two-minute service on the 4½-mile section between Tollcross and Ibrox; a six-minute service between Ibrox and Paisley, and an eight-minute service between Tollcross and Uddingston. In such instances, the only complaint comes from terminus riders who find that they cannot board through cars sometimes because the latter may be crowded with short-haul riders. The through rider is less inclined than Americans to board a short-line car and then get on a following through car at the city line, because this means a second fare instead of the presentation of a transfer ticket.

Up till about twenty years ago it was a widespread belief that the first-class passengers on railways were the chief contributors to revenue, though railway officials had long known that the case was exactly opposite. The Report of the Peel Commission in 1867 clearly showed that the backbone of railway passenger revenue was the third-class, but the superstitious reverence for the first-class survived till the last few years of the 19th century, when the condition of railway affairs became so critical that inquiry into all the facts became an absolute necessity. After that, the first-class passenger traffic was recognised as a costly form of advertising.

A similar process has taken place with regard to long-distance traffic on the tramways. In the early days the through passenger was considered most important by tramway authorities, but the essential quality of a tramway system is its adaptability to the needs of the short-distance traveller. Experience has shown that the latter is not only the largest factor, but also that he pays best for his ride. Mr. Jackson brings out the point clearly in his observation of the

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Glasgow tramways. The note occurs frequently in his discourse, but we quote only this typical passage :—

When the halfpenny a mile fare was established in December, 1911, there were many who expected the direst results. Instead, the traffic increased at such a rate that the revenue per car-mile showed a slight decrease only the first year or so. Thereafter it exceeded the former figures. The overwhelmingly large proportion of riders who travel a mile or less, and the heavy pick-up travel, are shown in diagrams in the official report for the year ended May 31, 1918.

It must be clear that the consequence of such travel as this will be reflected in the passengers per car-mile statistics, and it surely is. For the fiscal year ending May 31 last, the number of passengers per car-mile for the entire system was 16·41, with nearly 23 per car-mile on the Paisley Road and Alexandra Park line. The average passengers per car-mile for the week ending December 14, covering the entire Glasgow system, reached 20·33. American operators who check these figures against their own will wonder whether the zone system can be so complex as assumed if it is capable of handling such dense traffic.

Statistics alone do not tell the story. A few typical incidents may be given to bring out the short-ride habit among a people who have never had a reputation for wasting their money. Apparently car riding is considered cheaper than shoe leather. On a trip inbound from Scotstoun to Glasgow, between 11 and 11.30 a.m., the writer observed that a soldier and himself were the only males on the car. Even the crew were women. Many of the passengers were women with empty market baskets who actually rode half a mile or less. Here was little more than shopping travel. Evidently for every Glasgow man who goes to work someone is left at home to do the marketing; and under the Glasgow combination of short-ride fares and frequent service, the homekeeper rides quite as often as the wage earner.

On the trips taken in the industrial sections during the noon hours, a conspicuously large proportion of the riders were grime-covered workmen who were travelling to and from lunch as a matter of course. Later in the afternoon the travellers were women shoppers and school children. Again and again one was struck by the contrast between the empty sidewalks and loaded cars, which were running on a two to three minute headway.

Another serious problem which such a heavy traffic involves is the adjustment of seating accommodation to the number of passengers. According to the writer's observation, confirmed by charts compiled by the Glasgow officials, there is very little overcrowding on the cars, the seating accommodation being largely in excess of requirements on all routes, excepting for two short periods in each day. That is to say, the favourable financial results are not obtained by crowding the passengers in strap-hanging masses. Of course, from the point of view of tramway economics, a large excess of seating accommodation is wasteful, but the figures for density of traffic already given effectually dispose of that objection. Important factors in this relation are the spacing of the stopping places and the speed per hour of the cars.

Obviously, says Mr. Jackson, a street railway that wishes to relegate the walking habit among the lost arts must seek the happy medium between too many stops and too few. The peace-time standard averages 600 ft., or between eight and nine per mile, with some spacings as high as 900 ft to permit less than 600 ft. spacing of traffic-gathering points. To economise coal, 200 out of 1840 single stops were temporarily discontinued except on the extremely busy Paisley Road-Alexandra Park belt line, where short-ride traffic is so heavy that conductors sell 1,400 or more halfpenny tickets a day. The saving in coal has not been of any importance, partly because most of the stops eliminated were not frequently made at any time, and partly because the fluctuations in a large power plant are not materially affected by the elimination of a small percentage of stops. Most of the stops are near side.

In Glasgow there are no special speed restrictions for vehicles making less than 20 miles per hour. The schedule speed of the Glasgow tramway system as a whole is 8·18 miles per hour, which, in view of the dense traffic and low motoring, is not so much below American speeds as one might expect. In the outer sections, the cars make schedules up to 16 miles per hour, but in the crowded down-town streets it is hard to do better than four miles per hour. Hence, if part of the down-town travel could be diverted to parallel streets, the increase in schedule speed would make it unnecessary to consider special non-surface rapid transit. The high density of travel keeps the scheduled running times unchanged all day.

All this looks smooth and easy, but it is very probable that, at the back of the mind of the American reader, and perhaps some British readers too, there is a doubt as to whether the description exactly corresponds to the reality. Is there not, for instance, a large staff employed behind the scenes, labouring constantly with the complexities of the system which appears to run so easily in public? The *Electric Railway Journal's* investigator has all along been aware that such a question must arise, and has prepared to answer it. It is obvious that a conductor collecting fares at the rate of nearly 350 per hour, for a continuous stretch of five hours or more, has no time to fill up forms of any kind. Yet on each route there are eight denominations of tickets, each one of which has to be properly checked and accounted for. Though the method by which the apparent difficulty has been solved on British tramway systems is known to nearly everybody concerned in the work in this country, Mr. Jackson's description of it is worth quoting :—

Every conductor begins the day's work with packets of the serially numbered fare receipts applicable to his route. These receipts are obtained from the depot clerk. The tickets of each classification are made up in pads of 25 or 50, and bear an initialling identification in addition to the colours and numbers. As many as eight rates of fare (½d. to 4d.) are used at Glasgow, which corresponds to the number of sections in the conductor's ticket holder. . . . .

A record of the first number and letter identification of each classification issued is made on the conductor's waybill, which is issued in duplicate. Receipt for the tickets and their correctness in numbering and quantity is acknowledged by his initialling the waybill. During the day the conductor makes his returns to cash clerks *en route*, and not to the depot clerks. In making the return for either a half or round trip, as the case may be, he hands in the original of the waybill with his own record of the top numbers left on the pad of each classification.

It is the function of the cash clerk, and not of the conductor, to figure how many of each class of tickets have been sold, what the revenue per classification is, and what the last numbers of each kind of ticket are. In other words, the conductor makes a blind return by giving up all the money in his bag, exclusive of the 3s. 6d. with which he starts the day, leaving the cash clerk to note down the shorts or overs. On concluding his last trip at the depot, the conductor turns in his tickets, cash, and punch to the depot clerk. The latter simply counts the cash and leaves the checking of the ticket numbers to the receiving department. The receipt of this cash for individual conductors is entered in a cash receipt book, which goes to the receiving department daily. The transactions shown on the individual waybills are summarised on the "total" waybill, which represents a conductor's full day's work. This record, which is made up by the receiving department, shows not only the actual total discrepancy based on the difference between the tickets issued and the cash received, but also whether the punch registration itself is equivalent to the number of tickets issued.

So far as the cash discrepancies are concerned, 1½d. in a day, or 1s. in one week, is admissible. Discrepancies between the registration shown by the punch and the number of tickets issued generally are due to the failure to punch every ticket issued. A difference in excess of six means the counting of the punchings. This is a tedious job, since it is necessary to assort more than 1,000 punchings of different colours, a separate shade being used for each rate of fare. As soon as the shorts have been entered, the original waybills containing the notation of error are returned to the conductor's depot for his signed acknowledgment. On going back to the receiving department entry is made in the "shorts" ledger, and the waybills are filed for reference in case of dispute.

The labour involved in the auditing and checking of cash and tickets seems immense when stated in such detail, but the whole of the receiving department is fully staffed by 131 persons, mostly women and girls. There are, of course, ticket inspectors, and other such officials, to check abuses on the routes. As may be observed, however, the latitude allowed to persons of defective character is rather circumscribed. In reviewing the whole situation, Mr. Jackson concludes that the handling of fare receipts in Glasgow is a comparatively simple affair, especially as there are no transfer tickets to complicate the situation. With his concluding opinion that the checking up of the fare receipts is far easier than the checking of the time limits and other features of the American transfer, everyone at all familiar with the difficulties of inspection and the abuses to which the latter gives rise, will emphatically agree.

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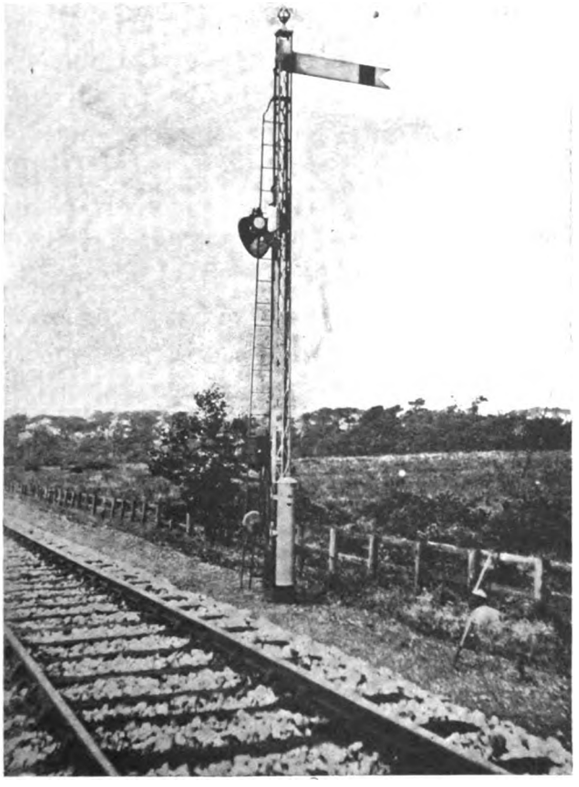
FLASHLIGHT DISTANT RAILWAY SIGNAL.

The speeding-up of railway traffic has greatly increased the importance of the distant signal. Formerly regarded as a mere precaution, the high standard showing on the railway track for miles ahead has become a necessity. In night operation especially the lamp of the distant signal gives the engine driver a much-needed assurance of a clear headway or a timely warning when the track is obstructed. Signal designers, however, have found it difficult to make a sufficiently strong differentiation between the lighting of the distant and the near signals, and to overcome the blanketing of fog. By their invention of the "Aga" flashlight distant signal for railways, Gas Accumulators, Limited, have offered a solution of the first problem and a very large gain upon the second.

The "Aga" flashlight signal is an adaptation of the company's system of marine signal lights which has



The "Aga" Flashlight as Distant Railway Signal.

been used for many years for lighthouses, lightships, and buoys in many parts of the world with success. The equipment is self-contained, and may be applied to any existing railway signal without interfering with the semaphore action. It comprises a cylinder containing dissolved acetylene gas, and a patent apparatus for displaying a light at frequent and fixed intervals. One cylinder provides illuminant for a known number of weeks or months, and the apparatus requires no attention of any kind during that period.

Because of its peculiar colour and intermittent action, the "Aga" flashlight enables the engine driver to recognise the distant signal at once, and at a greater distance than the ordinary lamp; the light penetrates fog and mist better than any other type, its penetrating power, as compared with oil or electric light, being five to one.

It should be clearly understood that the apparatus has long passed the experimental stage, having been in use for several years on the Furness Railway in this country, on several great American railway systems, and on a number of railways in Europe. Experience shows that the "Aga" saves much time in cleaning and changing lamps, and as the light is only burning at intervals instead of constantly, as in ordinary lamps, there is a considerable economy in the cost of illuminant.

CITY OF TORONTO MUNICIPALISES A STREET RAILWAY.

Provided the new agreement between the city of Toronto and the Toronto and York Radial Railway Company is approved by the City Council and ratified by the Provincial Legislature, the city will purchase the company's property and rights within the city limits. For two years the city has been discussing with the company the acquisition of that portion of its Metropolitan Division within the city limits. Arbitration proceedings were being carried out under an Act of Parliament which empowered the city to buy out the company in return for the retention of running rights by the company at a value to be determined by arbitration. The agreement, says the Canadian *Electrical News* of Toronto, will conclude the negotiations and render further proceedings by the Ontario Railway Board unnecessary.

The line of the Toronto and York Radial Railway Company which the city proposes to take over, runs between Farnham Avenue and Yonge Street, a distance of about 3.5 miles. The substance of the agreement is that the city purchase all rights, franchises and privileges owned or exercised by the company within the city limits, together with overhead and ground equipment, rails, etc., eight standard cars and all other property of the company within the city for £118,000.

As soon as the agreement becomes effective, the company is to cease the operation of its cars over that portion of Yonge Street within the present city limits and will establish a terminal station near the northerly city limit. If the physical conformation of the land on the west side of Yonge Street immediately outside the limits of the city renders it impracticable to establish a terminal station at that point, the company may erect such a station on a site within the city limits and may operate its cars between the city limits and such terminal station on tracks which are to be constructed and maintained, with the necessary structures and overhead line, by the city. For the use of these the company is to pay an annual rental of 7 per cent. per annum upon the cost of such construction.

The company retains the right to establish receiving and forwarding stations within the limits of the city, all such receiving, forwarding and terminal stations not to be situated on streets or squares or public places, and the transfer of any package, freight, or express goods is not to be made on streets or public places.

Until the city acquires the street railway now operated by the Toronto Street Railway Company the city is to provide cars to carry packages, freight and express goods of the company to and fro between the new Yonge Street terminal and the terminal to be provided by the company near Farnham Avenue.

After the street railway is acquired by the city, it is, if the company desires, to construct and maintain on the public streets of the city, the tracks and necessary structures and equipment required to give access for cars to the receiving, forwarding and terminal stations, and the company is to pay to the city the entire cost of the construction.

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THE
Tramway and Railway World

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THE EDITOR will be glad to consider articles by experts. All information of a practical character relating particularly to the engineering and operating branches of transportation will receive prompt attention. Original illustrations will also be welcome.

LONDON, MAY 15, 1919.

The Economics of Transport.

The organisation of the transport services of the nation is in the melting pot. Not only have we a Ways and Communications Bill which is designed to establish a Ministry that will control and direct public utilities hitherto managed independently by companies and local authorities; but necessity seems to demand Government supervision of the practical details of tramway, omnibus and other transport operations. Until recently, for instance, tramway and omnibus fare charges were regarded as matters which could be left to the adjustment of the parties immediately concerned—that is, the public using the service and the providers of it—within the limit of the Parliamentary "penny a mile" rule. Costs of materials and labour have risen, and omnibus companies and local authorities have thought it only just that the increased costs should be met by increased fares. Such a solution of the economic problem seems at once simple, just, and easy. Unfortunately the solution is too easy, and offers a temptation which controllers of undertakings are not always able to resist, and public policy demands that efforts be made to find other ways of getting over the difficulty. A tramway or an omnibus service may have become a necessity to the industrial life of a district, and the raising of fares may place upon an industry vital to the nation a dangerously heavy burden. Numerous enquiries are therefore started. The public asks all sorts of questions for which answers have not been formulated. Is it right, for instance, that a tramway undertaking should be burdened with the upkeep of the streets and roads on which its track runs? Or, are the dividends of a given omnibus company paid upon actual capital? Or, is the economic pressure upon certain undertakings directed to produce efficiency? These are only a few of the numerous queries now being raised in the public mind. Answers, and satisfactory answers, must be forthcoming, if worse trouble is to be averted. Then, as Sir William Bull has recently pointed out, facilities for travel have fallen far behind the necessities of the public. Provision of such facilities cannot be left to the hazard of private enterprise. Quite rightly, the private capitalist must be assured that such or such a project to which he is asked to subscribe will yield a fair return on the capital expended. But the public interest may demand that the service should be instituted, even though it may entail risk of loss in working for years. It will profit the nation as a whole greatly, and really result in great gain indirectly. Therefore, the duty of instituting such services must be laid on the nation, and the capital necessary should be provided from the public exchequer. At present, it is possible only to touch these few general aspects of the vast problem pressing for solution. The difficulties contained and the interest involved are so weighty as to call for earnest consideration and the greatest goodwill on every hand.

The Business Parliament.

The political complexion of the present Parliament may be admirable or the reverse, according to the standpoint of the observer, but it is safe to say that never before were the interests of industry, commerce, and labour so predominant in the House of Commons. Many worthy people look back with regret to the time when Members

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of Parliament represented purely political ideas, but whether we like it or not, we have to recognise the fact that the day of government by political party is over. So long as Parliament had to deal only with broad questions of national policy at home and abroad, the University man with his wide outlook, the lawyer with his trained intellect, and the politician skilled in the art of adjusting means to ends, served well enough ; but during the past 40 years Government has been brought more and more into touch with the business details of the national life, and instances might be given of the sad mess politicians made when called upon to deal with practical business affairs. Recrimination, however, is a profitless mode of argument. Whatever may be said of the past, there is no disguising the fact that Government is now at close grips with the industrial, financial, social, and commercial affairs of the nation. Industry is not merely the business of the individual manufacturer, but the concern of the whole people ; commerce is not a matter which may be safely left to the " higgling of the market," and the enterprise of shippers ; the remuneration of labour has ceased to be merely a matter of bargain between employers and workers. By the solution of the problems facing us in each and all of those departments, the nation will stand or fall, prosper or suffer. It is therefore inevitable, and good on the whole, that business men and labour representatives should predominate in the House of Commons. The conduct of the Standing Committee on the Ways and Communications Bill, during the sittings which concluded with the adjournment for Easter, affords a good example of the legislative methods we may expect in the near future. It may be said that the debates have been largely a conflict of interests, but anyone who cares to read the reports of the Committee will see something more than that. Here are men with expert personal knowledge of the subjects under consideration, stating their views and giving judgments. If they are trying to conserve a financial interest against the requirements of the nation, they give data and bring forward actual practical difficulties. The Committee is not bound to give effect to the desires inspiring the opponents of the Bill, but it benefits enormously by the knowledge they bring forth. In no case has a purely sectional interest dictated amendment of the Bill, but in some cases unintentional injustice has been avoided, and the efficiency of the measure has been largely enhanced. A Bill of such far-reaching scope, trenching upon so many interests, was bound to contain imperfections and provoke legitimate opposition in its first draft, and it is all to the good that it has been subjected to the keen scrutiny of those whose interests are most vitally affected. Legislation which creates grievances is bound to fail in the long run. Criticism of the Bill in Committee has strengthened it in two ways. On the one hand, the Government has made amendments which meet real objections and removed the possible causes of grievance, and on the other hand it has been shown that the main provisions of the Bill are sound and impervious to the attacks of loud-voiced agitation and the fallacies of pretentious authority.

Renewals and Repairs.

By this time there are very few undertakings whose management can contemplate further postponement of track reconstruction and repairs. The long period over which it has been impossible to obtain sufficient materials for the relaying of tracks has rendered imperative the carrying out of works more permanent than the scanty repairs effected during the past three years. This reason presumably accounts for the demand for manganese steel rails, points, tires, wheels, axles, and other railway and tramway steel, which is growing more insistent daily. It is further reported that the high steel prices have not, so far, hindered what is referred to as a fair development of the home markets. The leading steel firms, it is further asserted, appear to have plenty of good inquiries and even good order books. This may be regarded as a certainty, for the need is imperative, and, as before indicated, permits of no delay if safety of passengers is to be assured and damage to rolling stock prevented. When such contingencies have to be faced high prices cannot be regarded as justification for delay in the placing of orders. If any further argument be needed to persuade managers to action it is to be found in the statement that the iron and steel makers look for an inevitable further rise in the prices as

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soon as the subsidies are removed at the end of the present month. The most important consideration to be adduced in favour of this anticipation is that, with the removal of the subsidies granted to encourage the home production of pig iron when the submarine menace was growing, there may be a shortage of raw material. Yet it is difficult to understand why that effect should come about, provided the material is of as good a quality as that which can be imported. Pig iron imports are already being made by the Clyde from the United States, which is an indication that shipping is being liberated for commercial purposes. Further, it is said that manufacturers are threatening to import American basic billets. Doubtless there will be advocates for a continuance of the subsidies, but with the increasing liberation of tonnage such an aid to home production will be rendered futile unless a duty is placed upon the imports of raw materials, to say nothing of manufactured goods. Apart from the question of quality, there is the consideration of whether our stock of pig iron is extensive enough to meet demands, and also whether the nation would not gain more by conserving it for use in any future crisis. In the past the ease with which this country has obtained its imports of the raw materials for the iron and steel trades has enabled manufacturers to compete with the world. It would therefore appear to be the wisest policy to turn attention to one other influence which is stated to be "obscuring the outlook and causing anxiety regarding overseas trade." The other influence arises from the demands of labour. As a large volume of inquiries is already coming to this country from abroad, the need for a prompt settlement with labour is increased. These overseas inquiries convey a moral to British traction undertakings, apart from the need to provide work for labour displaced by the cessation of the war.

Home Office Traffic Powers.

A statement made in connection with the Ways and Communications Bill would appear to reveal a hitherto undisclosed reason for the failure to secure a Traffic Board for London. It had been supposed that the Government declined to settle the question on account of the contention of one section of the County Council that that body should hold the predominating position. A more likely reason is, however, that permanent officialdom installed in the Home Office refused to part with their control of traffic powers, other than those relating to through running to localities outside of their area. The responsibility for the decision has been put upon the Home Secretary as chief of the department. It is a matter of surprise that Mr. Shortt has consented to such a course in view of the unrelenting manner in which he has spoken for the Government in their resistance to proposals to lessen the powers of the new Ministry over any of the forms of transport included in the Bill. This out-of-date attitude of the Home Office will perpetuate the system of divided control of the traffic of the metropolis. Furthermore, if the Government do not insist upon ruling departmental officials in as stern and commonsense a manner as they have shown in other interests, they will be taking a step not only against the best interests of the metropolis, but one that will bring discredit on Royal Commissions and Select Committees. The unification of control was urged by the Royal Commission on London Traffic which sat in 1905 and by the Select Committee on Motor Traffic and Power-driven Vehicles which deliberated so short a time ago as the year before the war. The latter body urged "that in all metropolitan traffic matters Parliament should be advised by one department, which should combine the traffic duties of the Home Office, Local Government Board, and Board of Trade, including the confirming of by-laws." As Mr. H. H. Gordon has pointed out, the maintenance of the reported decision of the Home Secretary will cause a considerable amount of dual control and overlapping. Traffic by-laws made by local authorities for the purpose of "good rule and government" will require the sanction of the Home Office; other traffic by-laws such as speed limits, or the working of tramways, the sanction of the new Ministry. Constructional details of certain stage carriages will need the sanction of both. All motor drivers will be registered by the County Council, and drivers of hackney carriages by the Home Office, for whom the police act. There is wisdom also in Mr. Gordon's contention that the police should be concerned only with seeing traffic regulations carried out

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and should not continue their present limited task of prescribing the regulations. Than Mr. Gordon there is no public man in London who has made so extensive a study of traffic conditions in Europe, and he asserts that he has been deeply impressed with the superiority of London as regards co-operation and confidence between drivers and the controlling authority. He attributes the less desirable state of affairs on the Continent to the police being both the legislative and executive authority for traffic. The outlook of all forms of London traffic for obtaining fair treatment under the new Ministry is so good that the Home Office should not be permitted to perpetuate the conflict of interests that have hampered the more enlightened rule of the Board of Trade.

LONDON TRAFFIC CONGESTION.

SELECT COMMITTEE DEMANDED.

London Members of Parliament met in one of the committee-rooms of the House of Commons on Monday, May 5, to consider the question of traffic difficulties in the metropolis. Sir Harry Samuel presided over a large attendance. Mr. Frank Pick, commercial manager of the Underground Electric Railways Company, was present, and gave much interesting information relating to the working of the underground railways and the London General Omnibus Company.

Mr. Pick explained how the present congestion has arisen. At the outbreak of war, he said, the London General Omnibus Company, and companies with which it was associated, worked on an average 2,750 motor omnibuses in the streets of London. But as the result of an arrangement with the War Office, 1,319 of those vehicles were withdrawn from traffic and sent to France. The company thereupon took steps to restore the position on the streets as far as possible. The result was that in 1915 the number of omnibuses working daily on the streets was 1,928, and in 1916 it was 2,001. The next important factor was the rationing of petrol, and in 1917 that brought down the fleet of omnibuses in operation to 1,796. To-day the company were working on an average 2,062 omnibuses—an increase of 15 per cent. since the conclusion of the armistice. They were building up from spare parts which they had secured about 250 additional vehicles, and the War Office was returning omnibuses, a few of which the police authorities might pass as fit for service on the streets. They hoped by these means to provide a working fleet of 2,300 omnibuses. In 1917 the Commissioner of Police issued a notice to the effect that new motor omnibuses for London would have to comply with new standards both of design and construction. Experiments have been conducted with a view to supplying a type of omnibus which will comply with the more stringent regulations. The omnibus is not yet completely ready, and even if the police accept it a considerable time will be required to construct any number.

Asked to explain the reason of the recent increase of fares on the omnibuses, Mr. Pick said that it was to meet the increased cost of working. Working costs had risen by the following percentages:—

1914	4 per cent.	1917	64 per cent.
1915	22 ,,	1918	98 ,,
1916	32 ,,	1919 (3 mos.)	130 ,,

With regard to the last figure, 48 per cent. of the increase was due to wages and 48 per cent. to materials and petrol. Mr. Pick proceeded to say that he could give the profits for the whole combine for a series of years, but not for the omnibuses separately. After paying debenture interest and preference dividend the following sums of money were available for distribution on ordinary stocks in each year:—

1913	£409,271	1916	£462,868
1914	428,963	1917	476,237
1915	407,265	1918	558,191

Continuing, Mr. Pick stated that during 1915 and 1916 the congestion of traffic on the omnibuses was sufficient without an increase of fares to pay the increased costs. In 1917, when the expenses commenced to increase at a much more rapid rate, they soon discovered that their net earnings per omnibus mile were falling, and it was in that year they first began to increase fares. As the result of that increase the net earnings per omnibus mile in 1918 were exactly the same as in 1913. In the first three months of 1919 they had not earned any profit whatever on omnibus traffic in London.

Then the institution of the eight hours day meant that they needed 700 more skilled men to maintain their fleet of cars at its present level of efficiency, and the expenditure of an additional £24,000 on plant and tools. The real trouble on the Tubes arose from the fact that they had to absorb the passengers which the omnibuses could not carry, and the Tubes had carried 69 per cent. more passengers. They had not been able to buy a single car for running on the Tubes since the outbreak of war, and would not be able to do so until the end of this year. If a car had a really bad breakdown the labour and materials at their disposal during the war were insufficient to enable them to repair it. Consequently their fleet of cars in operation had been reduced from 544 to 504, and they were only now in a position to start overhauling the 40 cars which were not working.

In reply to a question as to the cost of a tube railway per mile, Mr. Pick said it cost about £1,000,000 per mile fully equipped. Answering Sir Samuel Scott, Mr. Pick said the reserve of the London General Omnibus Company dated back to 1912. They put aside £175,000 a year for the purpose of renewing their omnibuses. The reserve fund now amounted to £1,904,000, which, at £1,000 per omnibus, represented only 1,900 new vehicles. There was not enough money in the reserve fund to-day to replace the existing fleet of omnibuses. Was it unreasonable that a passenger should pay one-eighth of a penny towards the reserve fund for upkeep and renewals?

In reply to Sir H. G. Norris, Mr. Pick stated that the congestion of traffic on the Tubes had enabled them to postpone advancing fares. They got the money by crowding people in. There came a time, however, when the congestion of traffic was not sufficient to meet the increased cost, and then higher fares were essential.

The question was asked seeing that in 1918 they made £80,000 more profit, can you give us the reason for raising fares?

Mr. Pick replied:—When you increase fares you cannot foretell the exact result. You budget for a certain amount. Sometimes you get more and sometimes less. In times of war you have to be conservative in your estimates. That figure represents 1¼ per cent. more traffic receipts from the public, so that it is quite a trivial excess. We have not aimed at making profits by increasing fares, but at balancing our earnings and expenditure. If we have over-estimated it has been an ordinary commercial mistake. The position of our companies is not worse as a result of the war, but no one can say the position is good. The average earnings of all our companies is 3·64 per cent.

Mr. Pick, continuing, said that their companies afforded more facilities than any other undertaking in the kingdom, many of them at a loss. They had pioneered all kinds of developments. It was their policy still to give the best service they could at the lowest rate of charge. The moment they were in a position to give increased facilities and cheaper fares they would do it. They were of opinion that when the war period was over things would react and their expenses would not be so high. They were going to try to give everybody a seat again at a reasonable price, and they were now applying to Parliament for authority to raise £2,500,000 in order to improve London's traffic facilities. They were taking steps to enlarge the tunnels of the City and South London Railway so as to increase the size of the cars to the standard of other Tubes. The passengers carried by the companies he represented were as follows:—

1913	836,000,000	1916	818,000,000
1914	809,000,000	1917	832,000,000
1915	769,000,000	1918	901,000,000

The chairman having thanked Mr. Pick for the information he had afforded, Lieut.-Colonel Sir M. Archer-Shee moved the following resolution:—

> That this committee of London members strongly urge the Government to set up a Select Committee to consider the question of London traffic, and report what steps are necessary to relieve the present state of congestion.

Sir Samuel Scott seconded, and the motion was agreed to.

On the motion of Mr. Kennedy Jones, it was decided to appoint a deputation to interview the President of the Board of Trade and the President of the Local Government Board with the object of urging that immediate steps should be taken regarding the traffic difficulties. The following were selected as members of the deputation:—Sir Harry Samuel, Sir W. Bull, Mr. J. D. Gilbert, Sir A. Yeo, Mr. Kennedy Jones, Mr. C. F. Higham, Lieut.-Colonel Sir M. Archer-Shee, and Mr. Clem Edwards.

Fares Increased at Liverpool.—The Tramways Committee have decided to increase the fares on the basis of 1d. for 1·5 miles, with a proportionate increase for longer stages. One member of the committee proposed an amendment that no increase should be made until 50 per cent. of the reserve, now amounting to £406,280, was exhausted, but the amendment was defeated. It is stated that this increase in fares will mean additional revenue of about £140,000.

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RECONSTRUCTION IN FRANCE.

PLANS OF THE HIGH COUNCIL OF THE PUBLIC WORKS DEPARTMENT.

The Higher Council of Public Works was set up by a decree of the French Chambers of September 9, 1917. It includes, among other members, the general inspectors and directors of the central administration, which forms the General Council of "Ponts et Chaussées," Members of Parliament, the Council of State, and high officials of other Ministerial departments, as well as qualified representatives of commerce and industry attached to the Department of Public Works. The introduction of technical and business men into the Council has given the best results. Interesting innovations have been made in the procedure of business submitted to the Council, which when occasion arises consults Chambers of Commerce, representatives of industrial or commercial firms, and promoters of new enterprises. The Council is empowered to proceed at once to make investigations. Finally it is authorised to take the initiative in regard to all proposals relating to the improvement and the administration of ways and communications, as well as the creation, management, and distribution of motive power.

The Higher Council of Public Works consists of the full assembly, to which is reserved the examination of questions of a general character and affairs of particular importance under four sections (the planning and distribution of electrical energy, navigation, and utilisation of water power, maritime ports, and railways). The business of the railway section is brought before two or more sections sitting together when it relates to more than one class.

By a further decree of November 18, 1918, a Commission of Investigation was instituted, whose function it is to examine general questions, and to collate French and foreign publications relating to public works.

We give below a translation of a summary published in the *Revue Générale de l'Electricité* of a report prepared by the Higher Council for the Ministry of Public Works and Transport, and presented to the President of the Republic. The report was published in full in the *Journal Officiel* of February 3, 1919.

Matters Dealt with by the General Assembly.

We cite here only some of the business submitted to the full assembly since the constitution of the Higher Council. The Council has considered a proposed law dealing with the means for constructing and improving navigable waterways and ports. This project, as amended by the Council, has now been submitted for approval by the ministers interested. This is also true of a Bill for amending the Act of January 15, 1912, dealing with the management of ports. The Council has also taken the opportunity to make a temporary increase of 25 per cent. in the rates charged by the main railways. The project drawn up by the Government for permanently maintaining public works carried out during the war has been submitted to the Higher Council. The text prepared as a result of these deliberations has been favourably reported upon by the Commission of Public Works to the Chamber of Deputies. Beside these different projects the Council has had to examine a number of questions of considerable importance.

The Improvement of Communications between Switzerland and the Ocean Ports.—After a comprehensive investigation, in the course of which numerous interested parties were examined, the Council proposed the following programme:—As far as concerns the maritime ports, the execution as rapidly as possible of works acquired for the ports of La Gironde and La Rochelle-Pallice, and the continuation of an investigation upon the port of Saint Nazaire.

Concerning railways, the establishment of a new line, with easy gradients between Limoges and Saint Germain-des-Fosses, and as a first step the improvement of the actual running time of the expresses from Bordeaux to Lyons by means of the electrification of certain main lines, the strengthening and doubling of tracks, and the removal of zig-zags.

Reconstruction and Standardisation of Permanent Way.—The Higher Council has presented proposals, to which present circumstances lend special interest, relating to the standardising of material (rails, crossings, etc.) for railways, and the estimate of their requirements for the periods from 1919-1923, and 1923-1933. The principal object of these proposals is to provide information for the metallurgical industry upon the extent of the orders they will have to deal with.

Reconstruction and Standardisation of Rolling Stock.—Similar work has been done in standardising types and estimating orders for locomotives, carriages, and wagons. The Council in this connection urges the desirability of the opening by the principal railway companies of a common office or clearing house for research and the placing of orders. The object of these measures is to secure the standardisation of types of rolling stock and to improve organisation and manufacture throughout French industry, which for a long time has had reason for complaint under these heads.

Matters Dealt with by the Sections.

In view of the number of questions examined by each section, only the most important can be cited here:—Schemes for the extension of the ports of Dunkirk, Caen, Bône, Porte-de-Bouc, and Algiers, projects for the improvement of the old port at Marseilles, the establishment of quays at Mâcon and Châlon-sur-Saône to be served by the Paris, Lyons, and Mediterranean Railway; the project for the construction of a maritime station to be named Mirabeau at the port of Marseilles; projects for the alteration of bridges at Alma, Tournelle, and of Corbeil sur la Seine for the improvement of navigation.

The second section of the Council has considered eight proposals for the use of waterfalls of the Garonne, the Ain, and the Durance, powers varying from 2,000 to 32,000 H.P., giving a total of 150,000 H.P., which corresponds to an annual consumption of 750,000 tons of coal.

Work of the Committees of Investigations.

At present there are thirty-three Committees of Investigation, their function being to examine schemes for public works designed to improve the economic condition of the country. They examine schemes both from a technical and economic point of view, and draw up working plans for carrying out projects, and prepare estimates which will permit the practical carrying out of the work from available resources. They endeavour to avoid heavy interest charges during construction by assuring the use of the new facilities with the least delay. We may now glance rapidly at the work that has been done by these committees.

Routes.—This Committee has for its object the investigation of measures for the reconstruction of roads, the employment of special surfaces for certain specified roads, the organisation of services for maintenance, and the employment of new methods for such maintenance, the marking out of routes for tourists, the revision of the classification of roads and paths. The Committee has concerned itself with the repair of roads damaged or not maintained throughout the war, and has prepared the first project, including the supply and delivery of more than six million cubic metres of broken stone and of 2,800,000 square metres of paving for immediate use. The expense, which will be borne by the Treasury, is estimated at 275,000,000 francs, and will be spread over two years.

Improvement of Waterways.—The Committee deal with the following questions:—Extension of wharves, increase in the dimensions of basins, locks and bridges, improvement of dams, reservoirs, methods of haulage, railway connections and loading facilities, an organisation to deal with maintenance and repairs, particularly with a view to minimising periods of interrupted operation.

Canals and Navigable Streams in the North and North-East.—This Committee has been occupied principally with the study of the Nord Canal, which was under construction before the war. It had been designed for canal barges, but was partially destroyed in the course of hostilities. The Committee estimates that in its reconstruction it will be necessary to provide for boats of 600 tons, and has studied the enlargement of the channel and the construction of locks of a new type. The same Committee proposes soon to deliberate upon the extension of the Ardennes Canal to a junction with that of the Marne-Rhine.

Improvement of the Seine between Montereau and the Sea.—This Committee has considered a project including the deepening of the Seine to 4·5 metres between Bougival and Rouen, and it has formulated a scheme in which are indicated the works that can be immediately undertaken.

The Loire from Nantes to Briare.—This Committee, quite recently formed, is dealing with the most suitable means for rendering the Loire navigable. It will issue its report shortly.

Other committees are charged with the following inquiries:—The canals of the Garonne, Loire, Berri, Moulins-Sancoins, Loire to the Rhone, and the navigable waterways of the Sud-Ouest.

Utilisation of the Rhone from the Point of View of Navigation, Motive Power, and Agriculture.—This Committee has been actively studying the use of hydraulic power of the Rhone in its higher reaches, and the communications with Switzerland by way of the Rhone. It has investigated also the construction of a port at Lyons and the hydro-electric power obtainable from the Rhone at Lyons, the question of the irrigation of the valley of the Rhone, and a vast project including the management of the whole river. As far as concerns the use of the motive force of the Upper Rhone, the Committee is now having soundings taken to decide where the great dams projected are to be located, whether at Genissiat, or Malpertuis and Bellegarde.

Rhone-Rhine Canal.—The return of Alsace to France renders urgent the improvement of this canal. The Committee is investigating a project which will allow the passage of the big steamers of the Rhine and the Rhone.

Water Power.—A Committee for this purpose, particularly important for the economic future of the country, is investigating the possibility of the use of water power over a very extended area. With this object it is drawing up a list of the principal available waterfalls, investigating the means of making them serviceable, and of utilising them in the best interests of industry and agriculture. In order to facilitate its work the Committee is sub-divided into four sub-committees, dealing respectively with the utilisation of water power in the four great regions, the Alps, the Pyrenees, Centre, and East.

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Distribution of Electric Energy.—This Committee, whose function it is to investigate means for utilising electric energy, has undertaken an inquiry among the principal companies concerned in the distribution of electricity to ascertain their requirements, which will serve as a basis for any necessary improvement of present legislation. The Committee is also drawing up a general map of the existing system of distribution, especially the high tension lines. Upon this map existing omissions will be evident, and the best means that can be employed for dealing with them. The work that the Committee propose to carry out will include a map of new lines to be constructed, their situation, and classification in order of urgency.

Maritime Ports of Havre, Rouen, and the Seine.—This Committee has recognised the necessity of establishing a new railway between Rouen and Havre to serve the maritime establishments in the Lower Seine, and the ports of Rouen and Havre. On the other hand, it has considered the installation of a ferry across the Seine in the vicinity of Quillebœuf in order to obtain communication between the port of Havre and the south-west. This solution has been dealt with only provisionally, for the final means of transit will be a tunnel under the bed of the Seine. The State Railways had suggested a crossing above the estuary of the Seine. The Committee has proposed and is investigating a tunnel under the estuary itself between Havre and Honfleur. This Committee is also occupied with measures for improving the ports of Rouen and Havre.

Port of Caen.—This Committee has drawn up a general programme including the development of the quays and railways, the deepening of the canal which connects the port with the sea, and the improvement of the inner and outer approaches to Ouistreham, whose lock and jetties are to be reconstructed.

Fishing Ports.—This Committee has considered the construction of four great fishing ports, with a view to making the maritime industry an important element in the national food supply. These ports are Boulogne, Lorient, La Rochelle, and Cette on the Mediterranean. The Committee will also deal with the transport of fish by railways.

The Maritime Establishments of Saint Nazaire, Nantes, and Basse-Loire.—This Committee is investigating the improvement of these two ports and of the Basse-Loire. It thinks that the traffic arising from this source might amount to twelve million tons.

Finally, a Committee is concerned with the deep sea ports, which should be able to accommodate at any hour the largest present steamships or those that are likely to be constructed in the future.

Railways.—Different Committees are occupied with important questions relating to railways, such as the improvement of railway connections between Switzerland and the ocean ports, the tunnel under the Channel, the question of material available, etc. A special committee is dealing with the questions of permanent way and rolling stock belonging to light railways.

Electrification of Trunk Lines.—At its first meeting the Committee adopted a programme of works, and appointed two sub-committees, one administrative and the other technical. The administrative sub-committee has examined proposals for the electrification of three systems, viz., the Midi, the Paris-Orleans, and the Paris, Lyons, and Mediterranean Railways. These proposals cover a total of 8,200 kilometres of line, and include expenditure on hydro-electric stations, transformer, and feeder stations, and locomotives, of an estimated value of 2,400,000,000 francs. The technical sub-committee has drawn up a comprehensive report setting out the actual experience gained in France and abroad in the electrification of heavy railways. This report will serve as the basis for a discussion after a thorough demonstration carried out by such means as the committee consider suitable, and should lead to a determination of the best mode of electric traction for the French railways.

Other committees have considered the conversion of certain light railways into standard lines, and the work this will entail. Extensions of the present railway system are also incourse of investigation. A general section is preparing reports upon the use by France of the Port of Antwerp, international transit, the control of fares, and the means of transport dues to be levied on the ports and for the use of quays, the correlation of water and rail transport.

Such is in brief an analysis of the principal questions investigated by the Higher Council of Public Works. The programmes drawn up are magnificent. They seem too grand. Even with the best will of the Ministry of Public Works, is it possible they can be executed? Will not politics upset these programmes, which would give France an enormous development? Let us hope that the future will prove the contrary.

ELECTRIFICATION OF BELGIAN RAILWAYS.

According to the Belgian press, experiments in the electrification of railways (referred to on page 248 of this issue), are to be conducted on the line between Antwerp and Brussels. The execution of the necessary works will be offered for tender to the principal Belgian and Allied manufacturers.

LONDON COUNTY COUNCIL BILL IN PARLIAMENT.

POWERS SOUGHT FOR TRAMWAY EXTENSIONS AND MOTOR OMNIBUS SERVICES.

The London County Council has decided to apply to Parliament for authority to construct additions to their tramway system, and to seek powers to own omnibuses and run omnibus services. A Bill giving effect to these proposals having been presented to Parliament, with an explanation of the reasons why deposit of the Bill has been delayed beyond the statutory period, the House of Commons has agreed to the suspension of the Standing Orders so that the Bill may be proceeded with in the present session. The main provisions of the Bill are as follows:—

PROPOSALS FOR THE CONSTRUCTION OF NEW TRAMWAYS

(1) Double line, 5 furlongs 0·45 chains in length, from the existing tramway in Farringdon Road to Blackfriars Bridge *via* Farringdon Road, Farringdon Street, Ludgate Circus, and New Bridge Street.

(1a) Double line, 5·9 chains in length, from New Bridge Street by a junction with tramway No. 1 to Victoria Embankment by a junction with the existing tramway at a point 2½ chains eastward of junction of John Carpenter Street with Victoria Embankment.

(2) Double line, 2 furlongs 6·1 chains in length, from the existing tramway in Gray's Inn Road *via* High Holborn, Holborn Circus, and Charterhouse Street to Farringdon Road, terminating at a junction with tramway No. 1.

(2a) Double line, 2·04 chains in length, from a junction with tramway No. 2 at a point 1½ chains westward of the junction of Farringdon Road with Charterhouse Street to a junction with tramway No. 1 at a point 1½ chains southward of the junction of Charterhouse Street with Farringdon Street.

(3) 7·55 chains of double line, and 1·1 chains of single line, from Aldgate High Street at a point 1 chain eastward of the junction of Minories with Aldgate High Street to Whitechapel High Street, terminating at the existing tramway.

(4) Double line, 5 furlongs 3·4 chains in length, from the existing tramway in Hampstead Road *via* Tottenham Court Road to a point 1 chain north-westward of its junction with Oxford Street.

(5) Double line, 5 furlongs 0·5 chains in length, from the existing tramway in Seven Sisters Road *via* Amhurst Park to the existing tramway at Clapton Common.

(5a) Double line, 1·7 chains in length, from Amhurst Park at a junction with tramway No. 5 to Stamford Hill at a junction with the existing tramway.

(6) Double line, 1 furlong 7·8 chains in length, commencing in Hart Street, near Museum Street, *via* Hart Street, Bloomsbury Square, and Vernon Place to the existing tramway at the junction of Southampton Row with Theobald's Road.

Powers are also asked for the reconstruction of a small portion of the tramway of the Corporation of the City of London on Blackfriars Bridge and Victoria Embankment, and of the tramway of the Metropolitan Electric Tramways, Limited, in Seven Sisters Road.

Street Works.—Power is sought in this part to enable the Council to carry out street widenings in Charterhouse Street, Farringdon Road, and Vernon Place in connection with proposals for new tramways, and to enable the Metropolitan Borough Councils concerned to contribute towards the cost of such improvements.

Purchase of Lands.—This part contains powers relating to the purchase of lands for the purposes of the improvements, and is in similar terms to the London County Council (Tramways and Improvements) Act, 1915.

Motor Omnibuses.—Part V. of the Bill has been drawn to give effect to the decision of the Council on March 4, 1919, to seek legislation (i.) to enable the Council to own omnibuses, and to run auxiliary omnibus services for certain specific purposes, viz., linking up tramway dead-ends, including the provision of overlaps to traffic points, and providing auxiliary services in connection with housing schemes and proposals for tramway extension; (ii.) to enable the Council to operate omnibuses beyond the boundary of the County of London to traffic points, and to newly-developing districts and housing areas; and (iii.) to enable the Council to hold land and do all things necessary in connection with an omnibus undertaking. Provision has been made enabling the Council to apply to the proposed omnibus services certain of the Council's powers relating to the management and fares for tramways, and to make arrangements for through bookings with other tramway, omnibus, and railway services. Clause 18 (4) enables the Council to run motor omnibuses on any tramway route of the Council on which the running of tramways is interrupted. This provision is not specifically covered by the Council's resolution of March 4, 1919. Clause 20 provides that the omnibuses established under the Act shall form part of the tramways undertaking of the Council.

Miscellaneous and Financial.—This part contains provisions (i.) incorporating certain sections of the Council's Tramways Acts; (ii.) removing the limitations imposed on the Council by Section 14 of the London County Council (Tramways and Improvements) Act, 1912, in respect of the hours of user of the tramways in Tooley Street between Bermondsey Street and Joiner Street; and (iii.) enabling the Council to expend money on capital account for the purposes of the Act and to borrow money for such purposes.

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BRITISH WATER POWERS RESOURCES.

INTERIM REPORT OF THE WATER POWERS RESOURCES COMMITTEE.

With the object of obtaining a complete estimate of the hydro-electric resources of Great Britain, the Board of Trade instituted, in 1918, a special committee charged with the duty of surveying all the reasonably promising water powers in the British Isles, and investigating their economic possibilities. Last month, the committee issued an interim report dealing with nine water powers in Scotland, and outlining schemes which seem immediately practicable. The committee has taken a commendably broad view of its functions, and not only gives estimates of the probable commercial value of the proposed schemes, but also indicates the principles upon which acquisition of the water powers should be obtained and the schemes operated.

TEXT OF THE REPORT.

The interim report, which is addressed to Sir Albert Stanley, M.P., President of the Board of Trade, is as follows:—

The main purpose of this interim report is to bring to your notice certain practicable water-power schemes which may prove of assistance at once to the Board of Trade and to the Ministry of Reconstruction in providing employment for labour, not only on the works themselves but also in consequent and auxiliary trades, such as quarrying, cement making, steel constructional work, hydraulic and electrical plant manufacture, etc.

1. The committee has already collected a very large amount of data and taken evidence from a number of witnesses, while four well-known civil engineers have been retained for carrying out preliminary surveys in certain selected areas in Scotland and in North Wales. The evidence so far available to the committee indicates that there are considerable possibilities in other areas in Great Britain and Ireland, which still remain to be surveyed. The investigations required in Ireland will be carried out by the recently appointed Irish sub-committee.

NINE SCOTTISH WATER POWERS.

2. The reports in the possession of the committee dealing with a portion of Scotland alone show that nine water-power schemes hereafter referred to are capable of generating a continuous supply of 183,500 electrical H.P. corresponding to an output at the hydro-electric stations of 1,200 million Board of Trade units per annum.

The magnitude of these schemes will be better appreciated when it is pointed out that in the year 1917-18 the whole of the steam-power stations in Great Britain (public undertakings for electricity supply and for electric railways and tramways, but not private power plants) generated 4,628 million Board of Trade units and consumed 7·16 million tons of coal. Upon the basis of the present *average* practice at coal-fired power stations, the nine potential water powers thus represent the equivalent of 1·85 million tons of coal per annum.

3. In consequence of the modern developments in long-distance electrical transmission, it would be entirely practicable to transmit the electrical energy developed at these water-power stations to industrial centres in Scotland; for example, to Glasgow, the Clyde Valley, Edinburgh and District, Aberdeen, and Dundee. Allowing for losses in transmission and transformation, the nine schemes in question could deliver at least 1,000 million Board of Trade units within a radius of supply of from 80 to 85 miles.

The importance of these schemes is further emphasised by the fact that the total number of Board of Trade units generated in the year 1917-18 by all the steam-power stations in Scotland (including public utility undertakings, but excluding private power plants), amounted to about 537 million, and involved the consumption of over 806,000 tons of coal If the nine water-power schemes were fully developed, they would therefore be capable of supplying about double the present output for power, traction, and lighting purposes in Scotland.

4. As an alternative outlet for a part of this large amount of power, industries dependent upon considerable blocks of cheap power, for example, the manufacture of carbide or calcium cyanamide, or other electro-chemical or metallurgical processes, could be established close to those of the water-power stations which would be conveniently situated as regards railway and water transport.

5. The committee desires to emphasise the fact that the whole of this potential water power, which, as shown later, can be developed for the use and convenience of man at a commercially sound cost, is now running to waste. The value of these powers is brought into greater prominence by the continuous increase in the price of coal.

ESTIMATED COST OF DEVELOPMENT.

6. The nine Scottish schemes are briefly described in the following table, and their positions are shown on the accompanying map. [This map is printed in the Parliamentary Paper.] A full report upon each scheme is in the possession of the committee.

[NOTE.—Except in the case of Scheme A, the figures for the capital cost do not include an allowance for interest on capital during construction. This item would represent an addition of 7½ per cent. to the separate totals.]

Group.	Scheme.	Size. Continuous E.H.P.	Estimated Capital Cost. Total. £	Estimated Capital Cost. Per E.H.P. at power house. £	Approximate number of men required on the sites. 1st year to 3rd year.
A.	Loch Laggan ...	38,000	1,742,000	45·8	2,000—3,000
	,, Treig ...				
B.	,, Ericht ...	42,000	1,580,000	37·6	2,000—6,000
	,, Laidon ...				
	,, Rannoch ...				
	,, Tummel ...				
C.	,, Quoich ...	27,000	1,069,000	39·5	1,000—3,000
	,, Loyne ...				
D	,, Clunie ...	9,200	393,000	42·8	500— 900
	,, R. Moriston				
E.	Loch Monar ...	7,200	315,000	44·0	250— 750
F.	Lower Farrar ...	7,600	288,000	38·0	250— 750
G.	Loch Affric ...	31,000	1,133,000	36·5	750—3,250
	,, Mullardoch				
H.	Kilmorack Falls...	9,500	160,000	17·0	250
I.	Loch Awe ...	12,000	395,000	32·9	500—1,000
	,, Nant ...				
	Total ...	183,500	7,075,000	38·5 (average)	

BASES OF THE ESTIMATES.

The estimated costs of development are based upon pre-war contract prices with an addition of 50 per cent., which it is hoped will be ample to cover the post-war costs of works of this description. The costs are inclusive of all civil engineering and hydraulic works, power house, and plant, and of reasonable compensation for rights and property that would have to be acquired to carry out the developments. Materials for the construction of light railways and hutments would be available from military stores, and the costs of such materials are included in the estimates. Each scheme will take approximately 2½ or 3 years to construct; the labour required on the sites during the first and third years respectively being indicated in the last column of the table.

It may be noted that while the development of some of the above schemes would involve a certain amount of interference with local amenities, the aspect of the countryside would also be improved, owing to the fact that poor ground now liable to flooding would be permanently submerged and the area of the lochs extended.

7. Although only preliminary surveys have been made on behalf of the committee, the engineers employed for the purpose are of such high standing that the committee feels that general reliance can be placed upon the reports furnished by them. Moreover, the committee has corroborative evidence in support of some of the schemes, three of which have been thoroughly surveyed on former occasions and their costs of construction carefully taken out.

A SOUND COMMERCIAL BASIS.

8. The surveys and estimates of the nine schemes give a total continuous power of 183,500 electrical H.P. at an average cost of £38·5 per effective electrical H.P. developed at the water-power stations.

After a careful consideration of the post-war prospects of developing power on a large scale by the most modern steam turbo-electric practice, the committee has arrived at the conclusion that with similar conditions in regard to transmission and distribution, it would be possible for a water-power scheme of, say, 5,000 electrical H.P. or upwards to compete on an equality with the very best steam power station (assuming 12,500 British thermal units coal at 10s. per ton delivered), provided the cost of developing the water power did not exceed about £60 per effective electrical H.P. It will be seen, therefore, that the above schemes, individually and collectively, are well within the limiting cost for development on a sound commercial basis. In the case of schemes of smaller size situated remotely from existing power facilities, a higher capital cost per effective electrical H.P. would be permissible if the power were to be used for local requirements.

COST OF GENERATION.

9. The committee estimates that if the above schemes were fully developed and fully utilised, the average cost of the electrical energy generated, inclusive of all running expenses and capital charges, should not exceed 0·15 of a penny per unit at the water-power stations. It must be understood that such a cost would only hold in the event of the continuous use of practically the whole output by works situated near the power stations, e.g., by electro-chemical or metallurgical works. For ordinary industrial demands of a less continuous character, the cost would, of necessity, be greater.

The committee further estimates that the energy could be delivered into the industrial districts of Scotland at a cost which would be considerably lower than the present cost of electricity. The

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effects upon the districts would be markedly beneficial, smoke and dirt would be reduced, and a large quantity of coal would be saved or set free. (See paragraph 3.)

EFFECT ON LOCAL INDUSTRIES AND POPULATION.

10. If some of the schemes were utilised for the alternative purposes indicated in paragraph (4) the establishment of local industries would attract a larger population, bring about the development of transport, and also would lead to increased agricultural and dairy production to support the larger population.

The official representative of the Scottish Board of Agriculture and other witnesses have drawn attention to the serious situation in regard to the diminishing population in many parts of Scotland. These water-power schemes—and there are many others in various parts of Scotland which the committee is investigating—provide the means of promoting the resettlement of the people in or near their native location, and of bringing about developments in agriculture and dairying, and of railways or other transport facilities.

NATIONAL ASSETS.

11. The committee is unanimously of opinion that these potential water powers are to be regarded as national assets, and that any rights or property necessary for their utilisation should be acquired by the nation at reasonable and proper purchase costs.

The committee is further of the opinion that the water powers should either be developed by the State, or leased to a public or commercial undertaking for a sufficient term of years to enable the lessees to redeem the large capital expenditure by means of a small annual sinking fund which will not add unduly to the cost of the available power. This matter is at present under investigation and will be dealt with more fully in the final report of the committee.

12. If some of the above water-power schemes are to be begun at once for the useful employment of labour in 1919, the only possible way appears to be for the Government to promote a short Bill giving the Board of Trade powers to acquire the necessary rights, and for the Board to instruct the engineers at once to make further surveys where such are necessary, to prepare plans and to take out quantities, so that actual construction could be begun in the early summer.

Probably only a few of the schemes would be selected for immediate development, and the committee is prepared to advise upon this point.

OTHER BRITISH WATER POWERS.

13. The committee is in possession of further reports and estimates based upon surveys carried out in Scotland (Loch Broom area; also the area containing Lochs Glass, Morie, and Brora), and in North Wales, and promising schemes are indicated in each report. For example, there is a power in North Wales which is capable of developing 4,400 continuous electrical H.P. at an estimated capital cost of £41·8 per effective electrical H.P.

These reports are still under consideration and the schemes will be dealt with in more detail in the committee's final report.

14. Particulars have been submitted to the committee of potential powers in the Lake Districts, in Devon and Cornwall, and elsewhere. A scheme for the utilisation of the tides in the River Severn has also been put forward. It presents a number of interesting features, and is being further investigated by the committee.

15. There appear to be numerous small water powers in many parts of the country, ranging from 100 electrical H.P. to perhaps 2,000 electrical H.P. These are at present running to waste, whereas in many cases they could be usefully developed either for mills or for local agricultural and village requirements. Alternatively, the powers could be developed in automatically-worked stations, which would deliver energy into a general electrical transmission network or would serve to supplement existing coal-fired power stations. Water-power resources could thus be utilised in the same way as many sources of waste heat in this country.

The committee is proceeding with investigations in these directions.

PRINCIPLES OF DEVELOPMENT.

16. Official representatives of several English and Scottish Departments, and witnesses experienced or interested in water-power schemes, have given evidence dealing with the various claims that have to be reconciled in developing water powers, and with the general effects of such developments upon local industry, agriculture, fisheries, prevention of flooding, local amenities, and so forth.

Although these aspects of the enquiry are still under investigation, the committee feels it necessary to make certain comments at the present stage.

17. From the broad review of the position, it is abundantly clear to the committee that, in the development of the water-power resources of the United Kingdom, certain fundamental principles must be observed. For instance:—.

(a) The whole of a watershed must be thoroughly studied and the fullest use made of its potential water power consistent with reasonable capital expenditure. A development which would only result in a part of the power being utilised should not be permitted, if the ultimate use of the whole available power is thereby prejudiced.

(b) Proper regard must be shown to the interests of domestic and trade water supplies, fisheries, the drainage of adjacent lands, canals, and inland navigation, and in certain cases to local amenities.
Neglect to give consideration to some of these requirements has been responsible in the past for failure in the promotion of some water-power schemes.

(c) A part of the available power must be reserved for use by the local population within the watershed, both for present requirements and also for prospective developments.

It is important to remember, however, that in the case of large water powers considerably in excess of local requirements, it would not, in general, be commercially practicable to ensure a cheap local supply of electricity unless the powers were developed to the maximum extent and the bulk of the output utilised by an industry requiring practically a continuous supply throughout the year.

THE ADJUSTMENT OF CONFLICTING INTERESTS.

18. There are two outstanding factors which have been prominent in arresting the wider development of water-power schemes on a large scale in this country, namely:—

(a) The costly, protracted, and inefficient system of obtaining the necessary authority by means of a Private Bill.

(b) The multiplicity of interests to be reconciled.

19. With regard to the former paragraph 18a the committee is of opinion that if the rights necessary for the development of all water powers above a certain size were secured by the State, as and when required, many of the difficulties experienced in the past would disappear and preliminary waste of capital be obviated.

20. With regard to the question of multiplicity of interests, there is no doubt whatever that the powers now vested in numerous departments, boards, and other bodies concerned with different aspects of the water problem, require thorough revision and co-ordination. Many of the existing interests are or may be opponents of water-power developments, and if proper use is to be made of the valuable national asset represented by the potential water-power resources of the United Kingdom, the need of a simple, inexpensive and expeditious procedure for adjusting the claims of the several interests is vital. There is no question that a river system and its drainage area must be dealt with as a whole in regard to all the water problems incidental thereto. In this connection the committee desires to draw attention to the recommendations of Lord Elgin's Commission on Salmon Fisheries, 1902, which advocated, *inter alia*, the setting up of Watershed Boards under a Supreme Rivers Authority.

THE QUESTION OF CONTROL.

At the present moment the committee does not express any opinion on the question whether unity of control could best be effected by extending and co-ordinating the powers now possessed by departments, etc., or by the appointment of a new statutory authority or authorities with executive or only co-ordinating and advisory powers. The committee wishes, however, to emphasise the importance of the question, and to point out that it is a reconstruction problem which will undoubtedly require to be specially dealt with in the immediate future. The various aspects of the question are being examined in detail by the committee. In addition, the development of water powers for electricity supply purposes has a close bearing upon the recommendations of the Board of Trade Committee on Electric Power Supply, and will require to be considered in relation to any legislative proposals to give effect to those recommendations.

IMPORTANCE OF RAINFALL RECORDS.

21. The committee wishes to draw attention to the fact that the estimates of water power dealt with in this report have only been made possible by the voluntary work of rainfall observers in all parts of the British Isles, which has been collected and discussed by the British Rainfall Organisation during the past 58 years. If the fullest use is to be made of the water-power resources of this country, it is essential that the work of observation should not only continue, but should be encouraged and developed.

Another branch of observation which has a vital bearing upon the question of water-power resources is the gauging of the flow of rivers.

NEED FOR HYDRO-ELECTRICAL TRAINING.

22. Strong evidence has been submitted to the committee regarding the lack of adequate training facilities in the universities and technical institutes of the United Kingdom for young engineers wishing to enter the field of hydro-electric development. In view of the very large extension of water-power development that is practically certain to take place in the near future, both in this country, in the British Empire, and in other countries, the committee consider it important in the interests of British industry that steps should be taken to remedy this state of affairs.

The committee recommends that its views on this matter be brought to the notice of the Minister of Education, the Secretary for Scotland, and the Chief Secretary for Ireland, and suggests that Government support should be given where necessary for the initiation of special lectureships and courses in the subject of universities and technical institutes.

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REPORT OF THE LIGHT RAILWAY COMMISSIONERS.

The Light Railway Commissioners have presented their twenty-second annual report to the Board of Trade, dealing with the proceedings of this Commission up to December 31, 1918. The report states that a total of 687 applications for Orders to authorise light railways (which includes 124 applications for amending Orders) have been made since the commencement of this Act; details as to these respective applications and results are found set out in the appendices to this and to previous reports.

Results.

The total mileage of all classes of lines applied for under the Light Railways Acts since 1896 is 5,051 miles. Applications have been granted so far as this Commission is concerned for 2,272 miles; while the Orders confirmed up to this date by the Board of Trade authorise the construction of 2,101 miles.

Of these 2,101 miles, about 900 miles have been actually constructed, of which about 550 are on lands acquired and about 350 on roads.

Treasury Advances.

Of the 550 miles on lands acquired, about 325 are either owned or worked by existing main line railway companies; this figure of 325 includes all mileage aided by free grant from the Treasury (viz., 80 miles), such working being a condition precedent thereto, and 22 miles aided by loans of Treasury money; in addition to the 22 miles worked by railway companies, 23 miles in the hands of independent light railway companies have been aided by loans, to which as distinguished from free grants the condition as to such working is not attached. The amounts involved in these Treasury advances are about £143,000 in free grants, and about £60,000 in loans; in addition, conditional promises of aid from the Treasury, viz., about £34,000 free grants and £144,000 loans, have been made in respect of 71 other miles of line, not, however, so far proceeded with. It should be stated that these advances, or promises, were for the most part made in the early years after the Light Railways Act, 1896, was passed; and that, notwithstanding the proportion still remaining available of the sums assigned by Statute (altogether £750,000 for free grants and £250,000 for loans), and notwithstanding the large mileage of light railways which cannot be proceeded with owing to lack of funds, yet responsible promoters have not found themselves in a position to comply with the conditions under which the moneys are offered under the Light Railways Acts, nor in recent years either to ask for or to obtain special assistance from the State, to any material extent. We account for this by the fact that under the said Acts only a proportion of the capital in each case may be found by the State, and that in such cases the balance of private capital is seldom forthcoming.

Longer experience has confirmed the view indicated above that, except in cases where the prospect of some particular traffic, or the furtherance of some definite interest, may invite capital from independent sources, the provision of light railways will have to be made out of public money, whether from local or national sources, and under consequent public control. In this way the essentials of cheap capital, cheap construction, and cheap working might be arrived at; and, further also, a better security that each scheme with its details should be of the kind and on the scale best adapted to the circumstances.

During the last year we have submitted to the Board of Trade eight Orders for confirmation; three new applications received in November, representing 30 miles, remain to be dealt with. Other applications still before us pending final settlement are 14 in number and represent together 86 miles in different parts of the Kingdom; their final determination has been postponed either during the war crisis, or previous thereto pending the promoters' endeavours to arrange for the finance.

Recent Orders independent of State Aid.

The eight Orders submitted in 1918 will serve to illustrate the kind of railway which, being independent of State aid by reason of some special traffic, finds under the Light Railways Acts an inexpensive and practical procedure for authorisation. Of the light railways authorised by these eight Orders, two (Edge Hill and East Kent) are mainly for mineral traffic, iron ore and coal respectively; three (Formby, Swansea, and Lostock) are principally for passengers in the neighbourhood of large populations; the remaining three (De Trafford, Hooton, and Nottingham) are promoted for the industrial organisation and equipment of selected areas of land (on the lines of the Trafford Park estate, near Manchester), starting for this purpose with the provision of special transport facilities.

The object is to concentrate the factories established there in a favourable position for production by the most economical methods, and the promoters of such estates conceive that the railway lines and sidings which serve these factories and connect them with the main line systems, should be in the hands of separate and independent companies. Some of the main line companies, however, are not prepared to accept this view, and have claimed the right to construct the special lines and sidings themselves as part of their own railway in each case.

Agricultural Policy.

In respect of a proposed light railway from Longridge to Hellifield (24 miles), our approval was conditional on the promoters either obtaining a free grant for a considerable proportion of the cost or reducing the cost (if that were feasible) by an equivalent sum. The line would run through two valleys of pasture land now devoted to stock raising; these valleys are narrow, between high ground and open moors, and the permanent population is sparse, though the country-side, when accessible, would offer attractions to visitors and holiday-makers from the working centres near by. Though the climate is soft, the soil is fertile, and with a sufficient supply of labour, and of housing accommodation, and of cheap transport would probably afford a good yield of foodstuffs and a considerable consequential traffic. We refer to this case here in some detail, because it presents a problem which may be solved by way of the national policy as to increased agricultural productiveness; unless such increase is achieved in these valleys the line does not appear worth making, and without the line it can hardly be achieved.

Co-operation with Road Traffic, etc.

It is now generally recognised that there are many districts in Great Britain where an increase of population or a development of productive industry, usually both, are likely to follow upon better economic facilities of transport; but it may be advisable to add that other facilities of transport than by rail, whether by road or by water (or by any other system which may be developed), may in some cases as our experience indicates be more suitable or better obtainable, either alone or in co-operation with the railways, or in combination with each other. The tendency in some quarters to regard these various means as competitive with, rather than as complementary to, each other, may be aggravated by treating them separately in point of procedure, and by referring them to the cognisance and authority of different bodies. It would in many ways be an advantage if matters relating to all secondary means of local transport could be referred to the same bodies, or Government Departments, for the purposes of consideration and control, so that a measure of uniformity in practice, and of co-ordination in results, may be attained. The reference to secondary means of transport (such as are inferred by the expression "light" railways) rather implies a distinction of kind from such primary services as main lines afford, yet no dividing line between them can be clearly drawn, and it is material to note this because a certain insistence on the point of competition has tended in the past to obscure the extent to which each depends upon the other.

In conclusion, the Commissioners (Messrs. H. A. Stewart and A. D. Erskine) express their deep sense of the loss sustained in October last by the retirement of Mr. Gathorne Hardy from the Commission, of which he had been chairman since 1905, to be followed by his death on November 11, 1918, and need hardly refer to the length and width of his varied experience in the administration of and in the control over railways in this country, which serve to indicate the extent of that loss and of their regret.

Orders Confirmed by the Board of Trade.

A list of the Orders confirmed by the Board of Trade in the past year, with the date of confirmation and the mileage authorised, is appended. Only one of these Orders authorises fresh construction, the length of line in that case being 6½ miles and the estimated cost £63,000.

Name of Order.	Date of Confirmation.	Mileage authorised.
	1918	
411—Lancashire and Yorkshire (Formby Light Railway)	14 Sept.	6½
412—Swansea Corporation (Extensions) (Revival and Extension of Time) ...	14 Sept.	—
	1919	
413—Edge Hill	28 Jan.	5¾
414—Hooton	18 March	1⅛

Applications made in the Six Months ended November, 1918.

1.—Ashover Light Railway.

Railways in the parishes of Stretton, Shirland and Higham, Brackenfield and Ashover, in the county of Derby.

Promoters, T. H. Jackson, Brig.-General G. M. Jackson, and J. Steen. Length, 6 miles. Motive power, steam or electric. Gauge, 4 ft. 8½ in., and 2 ft. Estimated total capital expenditure, £68,712. Engineer's estimate for cost of construction, £50,955.

2.—Barrington Light Railway.

A railway from Foxton to Barrington, in the county of Cambridge.

Promoters, the Dreadnought Cement Company, Limited. Length, 1½ miles. Motive power, steam or electric. Gauge, 4 ft. 8½ in. Estimated total capital expenditure, £13,803. Engineer's estimate for cost of construction, £13,103. This is a renewal of a scheme previously rejected.

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3.—Hooton Light Railways.

Railways in the parishes of Little Sutton, Overpool, and Netherpool, in the county of Chester.

Promoters, Herbert Levinstein and Sir Harry Duncan McGowan. Length, 1¼ miles. Motive power, steam or other mechanical power. Gauge, 4 ft. 8½ in. Estimated total capital expenditure, £75,000. Engineer's estimate for cost of construction, £62,683. Local inquiry held at Chester on September 6, 1918. The application was approved

(An application made in July, 1918, under Rule 1,380. An Order was submitted to the Board of Trade on October 21, 1918.)

4.—Shropshire Light Railways.

A railway from Shrewsbury to Market Drayton, in the county of Shropshire.

Promoters, Lieut.-Col. H. F. Stephens, C. M. Mathews, and the Severn Syndicate, Limited. Length, 22¼ miles. Motive power, steam. Gauge, 4 ft. 8½ in. Estimated total capital expenditure, £199,095. Engineer's estimate for cost of construction, £160,673. Financial assistance is sought from local authorities.

This is the revival of a line for which powers given by Act of Parliament have ceased. The deposit made in respect of these proceedings has not been withdrawn; no land has been acquired and no work done.

TRAMWAY THROUGH RUNNING.

In the House of Commons, on April 29, Mr. George Jones asked the Minister designate of Ways and Communications whether he was aware that the London County Council tramway system was continuous with the Middlesex County Council tramway system at Stamford Hill, and that it would be a convenience to the public to have through running at Stamford Hill; whether he was aware that for years past there has been an insistent public demand for such through running of the trams at Stamford Hill, and that the London County Council and the Middlesex County Council have failed to come to an agreement, with the result that there is no such through running at Stamford Hill; whether under the Ministry of Ways and Communications Bill the Minister of Ways and Communications would have power to grant the right of through running to the London County Council and Middlesex County Council, and to settle the terms thereof; and whether, if the Ministry of Ways and Communications would not have the said power under the Ways and Communications Bill, he would propose an amendment to secure such power?

Sir Eric Geddes: Under the Ministry of Ways and Communications Bill, as at present drafted, the Minister would not have the power to control the through running of trams belonging to local authorities. The Government have, however, been pressed by members of the committee now considering the Bill to insert a clause which would give to the Minister power of control over municipal tramways, and the Home Secretary has intimated that a clause to this effect would have the sympathetic consideration of the Government.

YORKSHIRE AND DISTRICT TRAMWAY MANAGERS' ASSOCIATION.

At a meeting of Yorkshire and District Managers at Doncaster, the following members were present:—Messrs. E. S. Rayner (Doncaster), R. H. Wilkinson (Bradford), H. Jagger (Rotherham), W. E. Nicoll (Barnsley), J. V. Moinet (Scarborough), A. A. Blackburn (Huddersfield), J. W. Hame (York), H. England (Wakefield), E. A. Paris (Yorkshire Woollen District), H. L. White (Grimsby), and H. Webber (Keighley). After luncheon, the members adjourned to the car sheds and inspected the car that had been equipped with top-deck seats invented by Mr. Rayner. A meeting was afterwards held in the tramway offices, at which the agreement recently made between the Tramways Association and the Transport Federation was discussed.

NATIONAL TRAMWAY AGREEMENT.

Considerable differences exist between tramway employers and employees with respect to the interpretation of the agreement arrived at on March 20, and meetings have taken place at which these points have been discussed. The Licensed Vehicle Workers' Union at Bristol has complained to the Bristol Trades Council alleging a breach of agreement by the Tramways Company. Clauses Nos. 1 and 4 of the agreement are involved. Clause No. 1 provided that the previous wage for 57 hours should be paid for 48 hours. Clause 4 covered an arrangement for a conference between the employers and the men prior to the split duty being put into operation.

Electrical Trade with Poland.—The *Board of Trade Journal* reports that the electrical industry in Poland, owing to the proposed greater utilisation of electric power, will require to import turbines and motors for the re-equipment of mechanical workshops destroyed during the war.

AMERICAN STREET RAILWAY CRISIS.

Plans for Meeting the Situation.

A notable event at the mid-year meeting of the American Electric Railway Association, held at New York, was the presentation of the report of the committee on readjustments, which was presented by Mr. Gadsden, their chairman, as appended:—

Your committee believes that the questions submitted to it must properly be divided into two phases: (1) those dealing with urban street railways; (2) those dealing with inter-urban street railways; and that while the condition of both systems are in the main, the same, and while the causes of the condition are practically identical, the remedy often differs.

Your committee now has under consideration plans which, it believes, will assist in meeting the situation confronting the industry. These will be reported to you from time to time in detail. In its opinion, there are certain fundamentals which must control the readjustment of the relations between the companies and the communities they serve, and it presents for your consideration the following summary of these fundamentals:—

(1) That the electric railways are breaking down under present conditions of operations. As a result, the public is being deprived of service and is facing certain financial losses through the depreciation of electric railway securities which are largely held by savings banks, life insurance and trust companies and other similar institutions in which its savings are invested.

(2) That this condition is primarily due to the economic error of establishing an inflexible fare regardless of the cost of the service rendered or the distance hauled.

(3) That to correct this difficulty, flexible fares must be established which will be automatically adjusted to the cost of the service demanded by and furnished to the community.

(4) That a necessary element of the cost of service is such a return on the fund employed as will attract capital to the public service. To provide incentive to enterprise and initiative there must be an additional reward for economic management.

(5) That in the interest of the car rider, who must ultimately pay the cost of local transportation, every special impost and tax which cannot be justified upon the ground that it is payment for benefits received should be abolished.

(6) That to secure satisfactory service and keep fares as low as possible, the public must act on the principle of the "greatest good to the greatest number" and must co-operate with the operating companies in making effective economies by the use of "skip-stops," one-man cars, etc.; the speeding-up of schedules by reduction of vehicular interference.

(7) That electric railway transportation is a community problem to be solved by the community and the company acting together, and animated by a spirit of civic interest and devotion to the public service and having as its objective the establishment of such regulations as will give the public the greatest efficiency, economy, and enterprise in the operation of their transportation utilities.

(8) That the committee proposes to carry out as rapidly and as effectively as possible, the following programme:—

(*a*) To furnish to members of the association at as early a date as possible, information concerning franchise settlements and agreements along service at cost and other lines:

(*b*) To analyse these various agreements and present for the information of the companies such a summary of their provisions as will provide a guide in the drafting of new ordinances or agreements.

(*c*) To directly assist communities in which the readjustment of franchise relations are under way.

(*d*) To furnish at the instance of the railway company to civic organisations and similar bodies, information as to, and studies of, public utility questions.

In conclusion your committee recommends that the scope of the association's activities be so enlarged as to provide machinery for carrying out the purposes set forth herein.

In adding some remarks to the report, Mr. Gadsden stated that the committee's investigations confirmed that the condition in which the companies found themselves was not attributable entirely to the war, and that the war only emphasised the fact that the operating expenses of the railways were devouring them when their income was fixed.

The association have engaged the services of Mr. James W. Welsh as special engineer, and is prepared to assist member companies in the way of supplying information on practically all subjects pertaining to the operation of electric railways.

The Trolleybus.—Railless, Limited, of 56, Moorgate Street, London, E.C., have issued a reprint in an attractive form of an article on "Trolleybus or Motorbus," which appeared in a recent issue of The Tramway and Railway World. The pamphlet contains several interesting illustrations showing the flexibility of the railless system. Among the views are included trolleybuses at Shanghai, Bloemfontein, Bradford, Leeds, and Ramsbottom.

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WAYS AND COMMUNICATIONS BILL.

SHAPING THE MEASURE IN COMMITTEE.

The Standing Committee on the Ministry of Ways and Communications Bill began its sittings on Tuesday, April 1. It was agreed that the Committee should sit on Tuesday, Wednesday, and Thursday, from 11 to 1, and from 4 till 6.

Clause 1, appointment of Minister of Ways and Communications, came under discussion. The clause provides that for the purpose of improving the means of, and the facilities for, locomotion and transport, it shall be lawful for His Majesty to appoint a Minister of Ways and Communications, who shall hold office during His Majesty's pleasure.

Mr. Joynson-Hicks moved an amendment designed to limit the control of the Minister to Railways, but the amendment was rejected.

The Member for Twickenham returned to the charge with another amendment, moving that words should be inserted, " providing for the creation of a Board of Ways and Communications," instead of the Ministry contemplated by the Bill. Discussion of this amendment occupied the remainder of the sitting.

On Wednesday, April 2, discussion of Mr. Joynson-Hicks' proposal to amend Clause 1 of the Bill by provision of a Board instead of a Ministry was resumed. On the undertaking of the Home Secretary, Mr. Shortt, on behalf of the Government, that the Minister would have power under the Bill to set up consultative committees on the lines enacted by the Merchant Shipping Act, the amendment was withdrawn, and Clause 1 passed.

Clause 2 contains the crux of the Bill, defining, as it does, the powers of Ministry, which include control over railways, light railways, tramways, canals, waterways, roads, bridges, ferries, harbours, docks and piers, and the supply of electricity. Amendments were successively moved to omit light railways, tramways, and roads and bridges, many interesting points being raised in the course of discussion. With regard to light railways, Mr. Shortt stated that the Ministry would consult authorities on the best form of light railway, and the positions where they would be most advantageously placed. The Government considered that these lines were an integral part of the means of transport, and necessary to the industrial life of the country, and they could not consent to leaving them out of the Bill. The amendment was withdrawn. Similarly, the proposal to leave tramways outside control of the Ministry was negatived, Mr. Shortt pointing out that the powers taken over were exactly those already exercised by the Board of Trade.

The amendment proposing to omit roads, bridges, and ferries from control of the Ministry provoked serious discussion, but the Government refused to budge, and on a division they were supported by 38 votes to 8.

Sir W. Raeburn moved that " harbours, docks, and piers " be omitted from the Bill, and discussion of the amendment was continued over the greater part of Thursday's sitting. The amendment was rejected by 32 votes to 15.

A critical stage in the progress of the Bill was reached when the Committee proceeded to discuss the amendment proposed by Mr. Joseph Johnstone excluding the electricity proposals from the Bill. From the start it was evident that there must be some amendment made on the Government proposals, and the whole question aroused the keenest interest. As it was impossible to deal with such an important subject at the tail-end of an exhaustive sitting, the debate was adjourned till Tuesday, April 8. At the opening of Tuesday's sitting,

Mr. Shortt, on behalf of the Government, stated that when the Bill was drafted they hoped that the Electricity Bill, to be brought in by the President of the Board of Trade, would have been passed into law, and they included transfer of all the powers connected with electricity to the new Ministry on the assumption that the question of electricity supply had been settled. Owing to the illness of the President of the Board of Trade, however, this had been impossible. The Government were as convinced as ever that the control of electricity should be in the hands of the Department of Ways and Communications, but they accepted the amendment on the ground that it would be better to deal with the whole question when the Electricity Bill was introduced.

Mr. Joynson-Hicks moved an amendment deleting from Clause 2 words conferring upon the new Minister powers to transfer any powers of any Government department, with respect to the appointment of members, or the procedure of the Railway and Canal Commission, or of any Commissioners, Conservancy Boards, or other body Mr. Shortt said that the Government proposed to add words providing that " Nothing in the section shall transfer to the Minister the powers of the Board of Trade in respect to the appointment of members, or the procedure of the Railway and Canal Commissioners, but His Majesty in Council may by Order of Council transfer these powers to the Secretary of State instead of to the Ministry." With this addition, the amendment was agreed to.

Mr. J. D. Gilbert moved an amendment to Clause 2, the effect of which was to provide for the transfer to the new Ministry any powers of any Government department with respect to the bye-laws, regulations, orders, licences, approvals, or consents relating to any matters mentioned in the clause. He said that they thought in London that if they were to have one transport authority, and that transport authority was going to deal with tramways, it ought also to deal with motor omnibuses. The amendment was carried on a division by 17 votes to 10.

Sir Eric Geddes moved an amendment to delete the word " tramway " from the clause, and to insert words giving power to take possession of a tramway, other than a tramway, or light railway used as a tramway, belonging to a local authority. Mr. Joynson-Hicks asked if the Government were afraid of the municipalities. Sir Eric Geddes said that tramways were valuable undertakings belonging to the communities directly, and it was thought that they should be excluded from the scope of the Bill.

Discussion of Sir Eric Geddes' amendment was resumed on Wednesday, April 9 Mr. Renwick expressed the hope that, if the new Ministry obtained control of tramways, care would be taken that all tramways should have the same gauge. Great inconvenience was caused in connection with the tramway running from Newcastle to Tynemouth by the existence at the latter town of a narrow gauge line. The new Minister should also take care that municipalities who refused running powers over their systems were compelled to grant such running powers

Sir William Pearce argued that there should be in the Bill some provision, short of taking possession or of purchase, which would give the Government reasonable control over such undertakings as municipal tramways. He suggested that the Home Secretary should bring forward a new clause, giving some control over municipal tramways.

Sir Frederick Hall said the Minister-designate had stated, on the second reading of the Bill, that the tramways undertakings were paying 7 per cent. He pointed out that the gigantic and well-managed tramways undertakings of the London County Council were not paying such a percentage. Municipal tramways, in his opinion, should not make a profit, for the reason that they were worked on behalf of the ratepayers. The great idea was " to give a pennyworth of tramway for a penny." He rather agreed with the amendment, because the tramways, as a rule, were run in a competent manner.

Mr Shortt, replying to the discussion, admitted that he was impressed with the suggestion of Sir William Pearce that there might be in the Bill some general clause which would give power of control over such exempted services as municipal tramways. If a clause were suggested, the Government would be glad to consider it very sympathetically.

The amendment was agreed to.

Clause 3 (power to control temporarily railways, etc.) came under discussion at the sitting on April 10. Sir William Pearce moved that the Port of London Authority should be excluded from the undertakings to be taken over by the new Ministry. Mr. Shortt summed up the discussion with the remark that not one shred of a reason had been put forward to show why the Port of London should be excepted from the Bill rather than any other port. He refused to accept the amendment, and on a division the Committee supported the Government by 23 votes to 9.

Mr. Shortt moved an amendment, which was accepted, the object of which is to protect from the operation of the Bill privately owned railway wagons, and craft owned or held by the undertaking of which possession is taken by the Ministry.

Alterations in phrasing were effected by several amendments, the object being to define accurately the scope of the Bill in those particulars. Mr. Joynson-Hicks, however, brought the Committee back to facts by moving that any " rates, fares, dues, and other charges directed by the Minister " should be made subject to the existing rights of any person or body to apply to the Railway and Canal Commission in respect of any increase or undue preference. The Home Secretary admitted the importance of the question to the business community, and intimated that, before next meeting, he would endeavour to suggest alternative words setting up an advisory body of a semi-judicial character upon which the interests of traders would be represented.

On April 30 the Committee resumed sitting, and Mr. Shortt announced that a new clause had been drafted by the Government setting up a special advisory committee on rates, tolls, dues, etc., and he considered that committee would entirely safeguard the interests of traders. The proposed clause, which stands in the name of Sir Eric Geddes, contains six sections. It was pointed out that so great a change could not be discussed at such short notice, and after some debate a motion to report progress was carried without a division, the Committee adjourning after having sat for about twenty minutes.

At the resumed sitting on Thursday, May 1, the constitution of the proposed advisory committee on rates, etc., was discussed, and finally the number of the members of the Committee was fixed at six, giving due representation to all the interests involved. An amendment by Sir Eric Geddes, designed to safeguard agreements made by owners of undertakings previous to being taken over by the Government, was accepted.

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EFFECT OF CONCESSIONS TO EMPLOYEES UNDER THE NATIONAL AGREEMENT OF MARCH 20.

The Municipal Tramways Association, in view of the new agreement with the employees throughout the country providing for a 48-hour working week, the text of which was published in our issue of April 10, have approached the Government for the necessary powers to increase tramway fares. It is estimated that the new arrangement will impose an additional charge on the London County Council Tramways of £360,000 a year, and the wages bill of other tramway undertakings will be increased proportionately.

Birmingham tramway service has not suffered from the transition from the 54-hour week to the 48-hour week, though at least 200 men will have to be added to the staff in order to meet the new conditions. At present the men complain that owing to the traffic requirements they are unable to do their eight hours without a break, and in some instances it has taken as much as 17 hours for them to work their turns. "Birmingham," said Mr. J. Crump, of the Amalgamated Association of Tramway and Vehicle Workers, "is the only city where such heavy traffic both morning and night requires all the available men to work the service." It is hoped that arrangements will be made so that in future the men can do their eight hours in at least twelve. The tramways department has reported to the Tramways Committee that the concessions granted to the workers involve an increase in the costs of operating amounting to over £160,000 per annum. The Finance Committee, who have examined the proposals and the bill of costs, state that the increase of £160,000 referred to, and the probability of further serious expenditure, must involve an immediate increase in the tramway fares.

At Coventry Town Council meeting, Mr. Wale moved the adoption of a recommendation from the Tramways Committee:—"That application be made to the Board of Trade for their consent, under the Statutory Undertakings (Temporary Increase of Charges) Act, 1918, to an increase in the scale of charges not exceeding 50 per cent. above the existing statutory rates; and that, subject to such consent, a new scale of charges be adopted." Mr. Wale referred to the increases in wages which had been initiated by the Government and the Transport Workers' Federation. The position was that in the current year the increased wages of £2,250 were not included in the accounts, and owing to the increased amount of £9,750 decided upon by the Government and transport workers, their wage bill in 15 months would be increased by £12,000. They proposed to increase as far as they legitimately could their charges 50 per cent.—the maximum allowed by the Act. They proposed to do it in a way that would cause little inconvenience. He hoped they would secure the consent of the Board of Trade, or next year the ratepayers would be saddled with a charge of something like £12,000. Mr. F. Lee seconded the resolution, which was carried.

Mr. J. D. R. Cox, general manager, and Mr. R. Aitken, accountant of the Edinburgh and District Tramways Company, met the Tramways Committee of the Edinburgh Corporation on April 3 at an emergency meeting, and explained the position of the company with regard to the proposed reduction in the hours under the national agreement. The change would involve the company in a heavy loss unless they were permitted to increase the fares. The tramway employees had given notice to cease work on Sunday unless the company accepted the national agreement. An application had been made to the Board of Trade for an increase in fares, and the company asked the consent of the Corporation to the application. The committee agreed to support the application for sanction to an increase of the 1d. fare to 1½d., on the understanding that the tramway company would accept the national agreement. Subsequently the Board of Trade refused the application for powers to increase fares until evidence had been submitted by the company as to the financial effects of the changes in the hours and wages of the employees.

Councillor R. H. Swain, chairman of the Nottingham Tramways Committee, said that in 1914 the amount of wages was £46,200, electrical energy cost £27,900, and other expenses amounted to £31,000, making the cost per car-mile nearly 7½d. Under the 48-hours' agreement, with the same mileage as last year, the cost in wages alone would be £114,083, and including all other expenses the cost would be approximately 1s. 3d. per car-mile, or exactly double what it was in 1914. In addition, large sums would have to be spent in rolling stock and permanent way. Already the sum of £24,000 had been spent, and there was the cost of 25 new cars. Prior to the war their cars cost £940, and the last quotation was £2,300. Any reduction in the fares was impossible unless they made the undertaking a charge on the rates.

At Derby, under the national agreement, the working week has been reduced from 60 hours to 48, and the men are paid as for 57 hours. This entails a further addition to the extent of nearly £20,000 per annum. It has been decided to work with two shift service of employees. Where that is impossible the employees will be paid overtime rates. The Tramways Committee proposed to increase the fares, making the minimum for adults, except on workmen's cars, 1½d., and for children over three and under twelve, 1d. All the penny fares are thus abolished for adults, with the exception of the workmen's fares. Derby Town Council accepted the proposal.

Mr. W. T. Robson, general manager of Southampton Corporation Tramways, has stated that the reduction to 48 hours in the working week will entail an increase in the traffic staff of at least twenty pairs of men, and an increase in the wages bill of £12,000 per annum. To meet the situation it will probably be necessary to increase the existing fares by 50 per cent.

Birkenhead Corporation do not propose at present to increase the fares. Owing to the 48-hour week coming into operation, it has been necessary to increase the staff, but the Tramways Committee hope to avoid the necessity of alteration in fares.

Now that the 48-hour week is in operation, the Aberdeen Tramways Committee, like many others, are faced with a difficult financial problem. It has been estimated that there will soon be a deficit at the rate of from £500 to £600 a year in spite of the increased revenue. Halfpenny fares have always resulted in a loss, and it is possible that they will have to be abandoned. Hitherto the average length of the halfpenny stage has been 1,025 yards, and the average distance a passenger could travel for a penny was 1,716 yards.

It is estimated that the additional cost of the new arrangement to the Brighton Tramways Committee will amount to about £8,000 a year. The working week has been 60 hours, and this is now to be reduced to 48, with pay as for 57 hours.

At a meeting of the Wallasey Town Council Mr. W. H. Griffin, vice-chairman of the Tramways Committee, said that the recent arrangement for a 48-hour week for the tramway workers involved an increase of £10,000 a year in addition to the previous grants.

Bath Tramways Company will incur an additional yearly expenditure of £6,400 as a result of the reduction in the working hours from 58 to 48 per week. The total wages bill is now practically double the pre-war amount. Having obtained the sanction of the Board of Trade, the company have raised their fares on most routes about 50 per cent., the alteration taking effect on April 17. Wages paid by the company have increased £11,000 in the past twelve months.

At a meeting of Glasgow Corporation on April 3, Mr. Kelly, convener of the Tramways Committee, said that they were expecting a report from Mr. Dalrymple, the general manager, on the subject of tramway fares, and the report would be communicated to the Corporation.

To meet the additional charge for wages involved by the new national agreement, estimated at £140,000 per annum, Liverpool Tramways Committee recommended increase of fares on the basis of 1d. for 1½ miles, with proportionate increases for longer stages. The recommendation was accepted by the City Council.

Hull Corporation Tramways Committee recommended that the halfpenny fares for morning travellers be abolished, and several readjustments of ordinary fares, in order to meet the extra cost involved by the reduction of hours and increase of pay granted to workers by the new agreement accepted by the tramway authorities of the country.

Six additional members of the Exeter Town Council were appointed to confer with the Tramways Committee in regard to the proposed increase in the scale of fares. As a result of their deliberations, the Consultative Committee presented a scale of increased tramway fares to the Town Council. On the understanding that the scheme would come up for ratification or amendment three months from the date it is put into force, the scheme was adopted by the Council.

The new national agreement came into operation in Burnley on March 26. It is estimated that the introduction of this system will involve an increase in the expenditure of the Burnley tramway department of about £10,000 per annum. The changes are so far-reaching in effect that a considerable time must elapse before the conditions of the agreement can be fully applied.

At a conference between the Bradford Tramways Committee and representatives of the employees, details were discussed in connection with the 48-hour week granted to tramway employees throughout the country. The existing rates of pay will continue, and it has been arranged that a limited amount of overtime should be worked where necessary, to be paid for at overtime rates.

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A sub-committee of Dundee Town Council Tramways Committee has reported that, owing to the increase in employees' wages involved in the recent new agreement, estimated to amount to about £12,000 per annum, and, further, owing to the additional outlay of about £2,500 on streets, it would be necessary to adopt some means whereby the increase might be met. The Tramways Committee has accordingly recommended that the tram fares should be raised by about a halfpenny on all the longer distance routes. Workmen's fares are to remain the same, and through tickets are to be abolished. The committee points out that the wages bill for the week ending April 12 was £971, as compared with £371 in the corresponding week of 1914.

The Tramways Committee has presented a report to Croydon Town Council stating that the estimated cost of carrying into effect the new terms of agreement with the employees was £28,000 a year. The committee submitted a revised list of fares and stages by which it was hoped the increased expenditure would be partially met. The Council refused to accept the report, and referred it back for further consideration.

Kirkcaldy Town Council Tramways Committee has intimated that, in view of the increased cost of operation caused by the high cost of materials and increases in wages, tramway fares must be raised by at least 100 per cent. Decision has been delayed, however, till the close of the financial year on May 15th.

The London General Omnibus Company on April 13 made further alterations in motor omnibus fares, in continuation of the changes which came into operation on March 27. The increases have been made in order to meet the additional working costs caused principally by higher wages and the high price of fuel.

The London United Tramways on April 12 made further increases in their fares, and the charge is now 1d. per mile for ordinary passengers and ½d. a mile, minimum 1d., for workmen. Before the change in fares in January the average 1d. stage was 2¼ miles in length for ordinary passengers, and in some cases the distance that could be travelled for this sum was over three miles.

Fares on the Burton-on-Trent Corporation Tramways have been increased by about 50 per cent., the minimum fare being now 1½d.

Considerable differences exist between the tramway employers and employees with respect to the interpretation of the agreement arrived at on March 20, and meetings have taken place at which the points have been discussed, but a settlement has not yet been reached. The Licensed Vehicle Workers' Union at Bristol has complained to the Bristol Trades Council, alleging a breach of agreement by the Tramways Company. Clauses Nos. 1 and 4 of the agreement are involved. Clause No. 1 provided that the previous wage for 57 hours should be paid for 48 hours. Clause 4 covered an arrangement for a conference between the employers and the men prior to the split duty being put into operation.

JOINT INDUSTRIAL COUNCILS.

Alderman Flint, chairman of the Leicester Corporation Tramways Committee, at a recent meeting of the Council, referred to the formation of the Joint Industrial Council for the Tramway Industry, the constitution of which was given in full in our issue of March 13, 1919. All the tramway companies, said Alderman Flint, had fallen into line in the matter. There would be representative district committees, and if a difficulty arose which only affected Leicester, then the representatives of that undertaking and their employees would endeavour to settle it. If they could not do so, it would then have to go to the Council for the area, and, if they failed to agree, then to the national body. The main idea was to prevent friction.

WHITLEY COUNCIL FOR THE ELECTRICAL INDUSTRY.

The first meeting of the Joint Industrial Council for the electricity supply industry was held in London, on May 1. Mr. G. J. Wardle, M.P., Parliamentary Secretary to the Ministry of Labour, said it was the fourth Council established for industries or services in which local government authorities are concerned, the Councils for the waterworks industry, local authorities' non-trading services, and the gas industry having held their first meetings. The Councils for the electricity supply, gas and waterworks undertakings industries include both municipal and company-owned undertakings. Alderman W. Walker, of the Incorporated Municipal Electrical Association, was elected chairman, and Mr. A. de Turckheim, secretary of the Incorporated Association of Electric Power Companies, was appointed secretary *pro tem.*, for the employers' side of the Council. The trade union side of the Council will nominate the vice-chairman, and will appoint their secretary at an early date. All communications should be forwarded for the present to Mr. A. de Turckheim, Sanctuary House, 33, Tothill Street, Westminster, S W.1.

INCREASE IN LONDON TRAMWAY FARES.

The annual cost to the London County Council of giving effect to the national agreement between tramway employers and employees providing, among other concessions, for a 48-hour week, is estimated at £360,000. The effect of this charge on the tramways undertaking has been carefully considered by a sub-committee presided over by Mr. W. J. Squires, chairman of the Highways Committee, and as a result the committee made certain recommendations to the Council, which were approved on April 15. The new arrangement came into force on April 27 and the 1d. stage was reduced from 1·8 miles to 1·5 miles, with a single overlap in place of the present double overlap. The general effect is to add 1d. to each existing fare distance. Each route is divided into sections of ·75 miles, two consecutive sections being traversed for 1d., four for 2d., etc. Under the old arrangements the sections are of an average length of ·6 of a mile, and any three of these could be traversed for 1d. The increased revenue anticipated from the revision is £416,000, while a saving of £40,000 is anticipated from the improved fare collection owing to the shortening of the stages and the reduction in the hours of work for the employees.

The following scale has been adopted for workmen's return tickets: For a return journey over a stage of 2 miles (total journey 4 miles) 2d., over a stage of 3 miles (total journey 6 miles) 3d., 4 miles (total journey 8 miles) 4d., and above 8 miles total journey, 5d.

The Highways Committee in their report stated that the upward trend of wages had been continuous since 1914, as shown in the following comparison:—

	1913-14	1918-19	1919-20 (est.)
Total wages bill ...	1,102,220	1,888,600	2,421,250
Car mileage ...	59,209,289	48,052,801	53,000,000

War service allowances to men during the year 1918-19 amounted to £180,000, and the estimate for the current year for the smaller number of men still on service is £50,000. Simultaneously with the increase of wages the price of coal and materials has advanced in many cases more than 100 per cent Another factor is the urgent need for renewals of track and paving, which it has been impossible to carry out during the war owing to the shortage of labour and the impossibility of obtaining materials.

The working expenses since the year 1913-14 are given below:—

Year.	Car miles run.	Working expenses. £	A car mile. d.
1913-14	59,209,289	1,585,251	6·50
1914-15	58,978,792	1,684,243	6·89
1915-16	47,879,675	1,683,660	8·44
1916-17	49,478,973	1,817,693	8·82
1917-18	49,189,866	2,128,685	10·38
1918-19 (est.)	48,052,801	2,811,465	14·04
1919-20 (est.)	53,000,000	3,521,925	15·94

The renewals fund, which at March 31, 1914, stood at £539,749, at March 18, 1918, was reduced to £324,451. Up to the year 1911-12 a provision of two-thirds of a penny for each mile run had been paid to the renewals fund, but for the last six years provision could not be made on this basis, but the available surpluses have been paid into the fund. The general reserve fund on March 31, 1918, stood at £74,667, against £190,596, on March 31, 1914.

In May, 1917, the halfpenny fares were suspended and the average distance for a penny was reduced from 2 miles to 1·8 miles, and other reductions were made.

Prolonged debates took place on the proposals, Mr. G. Dew moving the reference back.

Mr. Davis (Labour Alderman) seconded, and urged as an alternative that the expenditure should be carefully watched for the next three months. If then it were found that the fares must be increased he and his party would support the committee and even consider the question of abolishing workmen's fares.

Mr. H. H. Gordon said delay was only a negative policy. It was obvious pre-war fares could not be continued.

The amendment was defeated by 94 to 28.

Mr. E. Davis moved, and Mr. Gosling seconded, an instruction to the Highways Committee to report as to the increased charges falling on the tramways during the next three months, and as to the road and other charges which the undertaking had to bear.

This was defeated by 94 to 18, and Mr. H. H. Gordon moved that the committee should consider the report on the charges imposed on the tramways which operated unfairly as compared with the charges imposed upon the omnibuses, and bring up recommendations for removal. This was lost by 48 to 60. Other amendments to secure the restoration of transfers were rejected, and eventually all the recommendations of the committee were adopted.

Protection for Tramway Passengers.—A Liverpool stipendiary on April 30 fined a chauffeur for driving into a crowd of tramway passengers leaving or boarding a car, who had to scatter in all directions to avoid injury. The stipendiary said such offences were becoming more common, and must be punished severely in the future.

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GLASGOW TRAMWAY FARES.

Schemes Abolishing Halfpenny Fares.

The increased expenditure of the Glasgow Corporation Tramways was discussed at a meeting of the Finance Sub-committee of the Tramways Committee on May 1, when the general manager (Mr. J. Dalrymple) presented a report on the position. In the course of his discussion, Mr. Dalrymple stated that every reduction in fares since the Corporation took over the tramways in 1894 had resulted in increased traffic revenue. It was now absolutely necessary to further increase this revenue in order to meet the increase in wages and the high cost of materials. It had been suggested that the further increase in revenue required should be obtained by a further reduction in fares. It must be quite clear, however, to anyone who had been observing the car traffic for the past two or three years that the department could not, with the present plant, carry any more passengers. To do so there must be more cars and better facilities for conducting the traffic through the centre of the city, and this would mean a very large addition both to capital and annual expenditure. Although additional cars were in course of construction it would be some months, owing to the great difficulty in obtaining materials, before any considerable number of these would be in service. What was wanted was an increased revenue from the present service. No one would surely suggest that more passengers should be crowded into the cars. In America it was quite common for a tramway undertaking to carry an average of six to eight passengers per car-mile, and in this country they used to consider 11 or 12 a very good average. During the past few months the average number of passengers per car-mile in Glasgow had touched 20. Yet this overcrowding was, under present conditions, absolutely necessary. Were it not for the overcrowding the financial position of the department would be hopeless. With an average revenue per passenger of ·78d., or about three farthings, it was impossible to make ends meet. Glasgow was perhaps the only place in the kingdom, may be in the world, where tramway fares were still as they were in 1914. With the present revenue only an immediate reduction in wages and in the cost of material would enable the department to meet its obligations.

Financial Position.

For the year ending May 31, 1918, the revenue was £1,421,215, and the expenditure £1,243,662, a surplus of £177,553. This result might at first sight appear to be highly satisfactory, but no charge appeared in the expenditure for interest on capital, and no provision had to be made for sinking fund. Of course it was not necessary to make any provision for sinking fund, as there was no debt to redeem. The result, however, could scarcely be said to have been satisfactory when the total surplus did not reach 5 per cent. on the capital investment. Some contended that it was not now necessary to charge revenue with interest on capital, as the indebtedness was all wiped off. It was hoped, however, that the Corporation would insist on a reasonable return from the tramways on the £4,000,000 invested in the undertaking. Mr. Dalrymple estimated that the revenue of the financial year which ends on May 31 would be £1,521,215, and the expenditure £1,474,800, a surplus of £46,415. The amount set aside for depreciation, £124,000, was the same as for the previous year, though that sum was now, on account of the great increase in the cost of materials and wages, quite inadequate.

The Increase in Wages.

The wages bill for the year 1913-14 was £441,048; last year it was £649,749; for the current year it was estimated at £830,000; and for next year at £950,000. The estimated revenue for next year was £1,571,000, and the expenditure £1,736,560 (including £245,000 for depreciation and renewals), showing a deficit of £165,560. His estimate of £50,000 increase in revenue was based on the assumption that work would be plentiful throughout the year and that wages would not fall. The cost of uniform would show an increase of about £20,000. Repairs and maintenance would show an increase of about £100,000. If they got the necessary material they would spend during the next twelve months on the track alone over £200,000. If one were satisfied that the present conditions were of a temporary nature it might be possible to carry on with the present fares. They were told, however, that wages were likely to remain, if not at the present level, at a much higher than the pre-war level. The present traffic conditions could not be allowed to continue, and the improvement of these conditions would cost millions. This money would require to be borrowed, and revenue would require to be raised to meet interest and sinking fund.

Halfpenny Fares.

In 1894 the Corporation started with a fare of ½d. for a half-mile stage and 1d. for a mile or thereby. The ½d. distance remained without change until 1911, when twice the distance was given. Prior to that date all the higher fares had been altered from time to time. Even in pre-war times no tramway undertaking in the country had anything approaching the number or percentage of ½d. passengers shown in the Glasgow traffic returns. Last year 63½ per cent. of all passengers carried in Glasgow only paid ½d. fare.

Schemes for Fare Revision.

Mr. Dalrymple suggested five schemes by which an increase in fares could be effected.

(1) By reverting to the scale of fares which obtained prior to 1901:—½d. one stage, ·58 of a mile; 1d. three stages, 1·74 miles; 1½d. five stages, 2·90; 2d. six stages, 3·48; 2½d. eight stages, 4·64; 3d. ten stages, 5·80.

(2) By charging ½d. per stage:—½d. one stage, ·58 of a mile; 1d. two stages, 1·16 miles; 1½d. three stages, 1·74; 2d. four stages, 2·32; 2½d. five stages, 2·90; 3d. six stages, 3·48.

(3) A ½d. added to each of the present fares would work out:—1d. two stages, 1·16 miles; 1½d. four stages, 2·32; 2d. six stages, 3·48; 2½d. eight stages, 4·64; 3d. ten stages, 5·80.

(4) A scheme somewhat more favourable to the passenger would be to abolish the ½d. fare, but to give three stages for 1d. instead of two, as in Scheme No. 3, and to give two stages for each additional ½d.:—1d. three stages, 1·74 miles; 1½d. five stages, 2·90; 2d. seven stages, 4·06; 2½d. nine stages, 5·22; 3d. eleven stages, 6·38.

(5) Another scheme proposed was to accept only a special token with a face value of ¾d. for the present ½d. distance; these tokens to be purchased in quantities at face value, and no cash to be accepted for any fare less than 1d. The scale of fares under this proposal would be:—¾d. two stages, 1·16 miles; 1d. three stages, 1·74; 1½d. four stages, 2·32; 2d. six stages, 3·48; 2½d. seven stages, 4·06; 3d. nine stages, 5·22.

Commenting on the various schemes, Mr. Dalrymple said there was no doubt that the ½d. fare was a great boon to those who had to use the cars frequently for short distances and for those who went home for a midday meal, but the time had come when even the short distance passenger should pay more. He was convinced that the larger income necessary to meet the increased expenditure could only be obtained by raising the fares, and that the simplest and most equitable arrangement was to add ½d. to each of the present fares,

SHEFFIELD THREE-HOUR STRIKE.

Recently very conflicting and almost unintelligible reports have appeared in the public Press regarding the strike of Sheffield tramway employees which took place on Sunday, April 27. At a meeting of Sheffield Corporation Tramways Committee, held on Tuesday, April 29, the subject was discussed, and an official report was supplied to the Press, of which the following is a summary:—On Sunday, the 27th inst., in consequence of a dispute regarding the interpretation of the agreement dated March 20, which had been arrived at between the representatives of the Municipal Tramways and the National Transport Workers' Federation, the traffic employees held a meeting on the morning of that date and passed a resolution that until certain disputes with regard to the interpretation of the agreement had been settled in their favour, no man was to be allowed to leave the meeting-room, and the cars were not to be taken out in accordance with the time tables for Sunday noon. The general manager reported that having addressed the meeting, ascertaining exactly what their objections were to the interpretation that was being placed upon the agreement, he had endeavoured so far as was reasonably possible to meet the wishes of the men in regard to the matter, and fixed up, at any rate as a temporary measure, the working arrangements until such time as the new duty sheets could be brought into operation. The Committee having heard the full report of the general manager in regard to the meeting and negotiations that had taken place, expressed their grave disapproval of the unwarrantable action of the employees in calling a strike without the slightest notice to the department. In consequence of the action of the tramwaymen, the Sunday tramway service, which starts at noon, was delayed for nearly three hours, to the serious inconvenience of the public.

On Friday, May 2, Sir William Clegg, chairman of the Tramways Committee, and Mr. A. R. Fearnley, general manager of the tramways department, were waited upon by a deputation from the Amalgamated Association of Tramway and Vehicle Workers, consisting of Mr. N. Bradwell, assistant general secretary, Manchester, Mr A. Clark, president of the Sheffield branch, Mr. E. Smith, member of Sheffield branch committee, and Mr. F. Thraves, local secretary. The whole position was discussed at length, and certain agreements were reached which the deputation undertook to recommend to the men for acceptance. A reasonable spirit governed the negotiations, with the result that a critical situation was relieved.

On Sunday, May 4, a mass meeting of Sheffield tramway workers, held in the Tivoli Theatre, ratified the terms of settlement. To facilitate attendance at the meeting, and enable the men to reach their posts of duty when the meeting was over, the Corporation allowed a number of cars to be requisitioned for the purpose. Marked "Private," and driven by volunteers, these cars were of the greatest service, and the men appreciated the friendly spirit thus brought into evidence.

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MANCHESTER TRAMWAYS ESTIMATES.

The general manager of Manchester Corporation Tramways (Mr. J. M. McElroy) has submitted his annual estimates for the year ended March 31, 1920. From the details given below it will be seen that the traffic revenue is estimated at £1,480,000, and miscellaneous revenue (including motor omnibuses and parcels traffic) £9,800, making a total of £1,489,800, an increase of £120,549 on last year's figures. The expenditure is estimated at £1,377,910. Allowing £90,000 for the renewals fund, the estimated balance is £111,890, which may be allocated to the City Fund in aid of the rates. The detailed estimates and the general manager's notes upon them are appended.

ESTIMATED REVENUE ACCOUNT FOR YEAR ENDED MARCH 31, 1919.

Year ended 31st March, 1919		EXPENDITURE.	Estimate 1919-20
Estimate.	Approximate Expenditure		
£	£		£
277,500	296,345	1 Traffic expenses	598,270
87,000	98,483	2 General expenses	118,180
108,750	133,475	3 Repairs and maintenance ...	188,930
148,500	154,763	4 Power expenses	176,340
304,620	288,053	5 War service allowances, bonuses, etc.	*a*15,000
49,400	47,791	6 Interest on loans, etc. ...	47,140
28,220	27,687	7 Rent, etc., of tramways ...	27,700
500	469	8 Leaseholds—proportion written off	450
67,203	67,357	9 Sinking Fund and loan instalments	69,400
126,000	109,452	10 Renewals Fund	90,000
6,000	6,224	11 Street improvements—interest, etc.	6,500
20,280	27,687	12 Income-tax	40,090
111,890	111,890	13 City Fund in aid of rates ...	111,890
1,335,863	1,369,676		1,489,800
		INCOME.	
£	£		£
1,318,753	1,359,451	14 Traffic revenue	1,480,000
17,110	10,225	15 Miscellaneous revenue, including motor omnibus and parcels traffic	9,800
1,335,863	1,369,676		1,489,800

(*a*) War service allowances only. In this year's estimates war bonuses are included in the Operation Accounts.

The estimated expenditure on capital account for new lines and cars is £200,000, and application for borrowing powers has been made for this outlay.

The general manager submitted the following notes on the estimates :—

The estimates prepared at the beginning of the last financial year showed a deficiency in the revenue of £181,753, which had to be met by the adoption of an increased scale of fares. The increased scale of fares was put into operation about the middle of the year, and the total revenue reached £1,359,451, an increase of £251,287 on the previous year's revenue.

The net result of last year's working shows that after making provision for the payment of £111,890 to the City Fund (being 5 per cent. on the capital expenditure—the percentage fixed by the Council), the sum of £109,452 was placed to the renewals account.

The estimates for the present year show that after making provision for the payment of £111,890 to the City Fund, a sum of £90,000 will be available for the Renewals Fund. The estimated traffic revenue is £1,480,000, an increase of £120,549 on last year's figure. This increase must be regarded as a somewhat optimistic estimate, but if it is not realised the committee may have again to consider the question of a further increase in the fares to meet the extraordinary growth in the expenditure.

On the expenditure side it will be noticed that the war bonuses have now been merged in the operating accounts. In these accounts is also included the estimated cost (£70,000) of granting the 48-hour week and other concessions included in the recent national agreement with the Transport Workers' Federation. The wages (including bonuses) now being paid by the department on revenue account show an increase of about £400,000 per annum when compared with pre-war years, the increase being about 117 per cent.

The renewals fund now stands as follows :—

	£	s.	d.
Amount at March 31, 1918	364,150	0	0
Add for year 1918-19	109,452	0	0
	473,602	0	0
Less expended during the past year ...	44,151	0	0
	429,451	0	0

The capital expenditure at March 31, 1919, was £2,237,827, and the outstanding debt, £1,458,814.

The following figures show the growth of revenue and the passengers carried during the past few years.

Year ending March 31.	Revenue.	Passengers carried.
	£	
1915	887,763 ...	202,768,420
1916	925,301 ...	209,877,667
1917	965,829 ...	219,151,984
1918	1,108,164 ...	240,914,369
1919	1,359,451 ...	253,930,220

NEWCASTLE TRAMWAYS.

The annual report of Mr. Ernest Hatton, engineer and general manager, shows that both the income and expenditure of the Newcastle Corporation Tramways have again considerably increased. Alluding to the continued tendency for increases in expenditure, Mr. Hatton says that the undertaking is about to pass through the most difficult period of its existence, inasmuch as the income cannot go on increasing at the rate it has done during the last few years, and there is little prospect of the expenses decreasing except under certain headings. Consequently, with the alterations which are taking place daily, some revision of fares must be considered. The comparative figures show the traffic revenue in 1917-18 to have been £409,114 5s. 1d., as against £346,334 4s. 3d. in 1916-17. Other revenue was £8,914 6s. 7d., against £10,200 12s. 4d., making a total of £418,028 11s. 8d., as compared with £356,534 16s. 7d. The working expenses increased from £203,399 0s. 11d. to £248,394 2s. 3d. the balance (gross profit) on the year being £169,634 0s. 5d., as compared with £148,235 15s. 8d. Adding to this the interest on investment, there was a sum available of £176,512 11s. 5d., against £154,619 0s. 11d. in 1916-17. Among the charges met out of this was a sum of £16,830 15s. 10d. for dependents of men on service, and there was a final balance of £90,785 17s. 3d., as against £62,902 17s. 5d. This was appropriated by income-tax, contribution to rates (£14,000 against £7,000), insurance reserve and renewals fund, in which there was a balance of £155,251 1s. 2d. The following items in the statistical information are of interest :—

	1917.	1918.
Car-miles run	5,833,800	5,971,329
Passengers carried	78,189,246	91,648,545
Passengers carried per car-mile ...	13·41	15·35
Traffic revenue per car-mile	14·53d.	16·82d.
Average fare per passenger	1·084d.	1·095d.
Cost per passenger	0·639d.	0·650d.

RESULTS OF INCREASED FARES AT BRADFORD.

An interim report on the result of last year's operations on Bradford Corporation Tramways, just issued, goes some length towards justifying the contention that raised fares will have the effect of improving the financial outlook of tramway undertakings. For the 364 days covered by the report, there were 7,709,703 fewer passengers than in 360 days of the previous year, and yet there was a net increase in receipts of £92,075. This increase is wholly due to the higher fares, as may be seen from the following table :—

		Increase.
Traffic receipts	£451,877 ...	£89,964
Railless vehicle receipts ...	15,122 ...	2,873
Miscellaneous	5,491 ...	394
Parcels	11,974 ...	—
Total	£484,464 ...	£93,231
Decrease in parcels		£1,156
Net increase ...		£92,075

The actual number of passengers carried was 76,419,459, as against 84,129,252. The car-miles run were 5,269,834, and the receipts per car-mile were 22·06d., an increase of 6·12d. The total number of units consumed for traction purposes was 11,027,312, a decrease of 1,372,202.

STANDARDS FOR ELECTRICITY MEASUREMENT.

The Board of Trade announce that the coils and instruments referred to in the schedule to the Order in Council of January 10, 1910, which approved the several denominations of standards set out in that schedule as denominations of standards for the measurement of electricity will on and after May 8, 1919, be deposited at the National Physical Laboratory, Teddington, Middlesex, instead of at the Board of Trade Standardising Laboratory, 8, Richmond Terrace, Whitehall, London.

All communications respecting electrical standards and instruments for test should be sent to the Director of the National Physical Laboratory, Teddington, Middlesex.

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FINANCIAL REPORTS AND MEETINGS.

MELBOURNE TRAMWAYS AND OMNIBUS COMPANY.—A dividend of 1s. per share is announced.

THERMIT, LIMITED, are supplying material for 600 Thermit-welded joints to Bradford Tramways Committee.

THE BRIDGEPORT BRASS COMPANY has an order for phono-electric trolley wire from Glasgow Tramways department.

HADFIELDS LIMITED, have received orders from Hull and Dover Corporation Tramways Committees for points and crossings.

POTTERIES ELECTRIC TRACTION COMPANY, LIMITED.—A dividend is announced of 5 per cent. per annum on the ordinary shares.

TYNEMOUTH AND DISTRICT ELECTRIC TRACTION COMPANY.—A dividend is announced on the ordinary shares at 8 per cent., £1,000 is carried to reserve, and £1,940 forward.

WALTER SCOTT, LIMITED, are supplying 800 tons of high silicon steel rails to Bradford Corporation Tramways at £18 12s. 6d. per ton; 150 tons are to be treated by the Sandberg sorbitic steel process.

EDISON ACCUMULATOR COMPANY, LIMITED, are supplying three electric vehicles at £1,304 each to Taunton Town Council. One vehicle will be provided with an interchangeable body at an extra cost of £300.

W. T. HENLEY'S TELEGRAPH WORKS COMPANY.—A final dividend is announced on the ordinary shares at the rate of 2s. 6d. per share, less income-tax, making, with the interim dividend of 6d. per share, 3s. per share for the year.

BOMBAY ELECTRIC SUPPLY AND TRAMWAYS COMPANY.—The directors recommend a dividend on the ordinary shares at the rate of 14 per cent. for half-year ended December 31, together with a bonus of 2 per cent. for the year.

LANARKSHIRE TRAMWAYS COMPANY.—A dividend of 11s. per share is announced for the second half of 1918. For the first half the company paid 7 per cent., and the total distribution for the year is thus 9 per cent. Due provision has been made for upkeep and depreciation.

PLYMOUTH CORPORATION TRAMWAYS.—The annual financial statement shows that the total income amounted to £121,047, of which £33,024 was gross profit. After payment of capital charges, etc., the net surplus is £10,679. Of this amount £6,000 is to be appropriated for working capital, and the balance of £4,679 carried to the reserve fund.

NORTHERN GENERAL TRANSPORT COMPANY.—After providing £5,189 for renewals, the profit balance is £38,841, as compared with £22,589 a year ago. The dividend on the ordinary shares is raised from 6 per cent. to 8 per cent., £1,584 is carried to the sinking fund for redemption of debenture stock, and the undivided balance is increased from £6,626 to £12,565.

EDINBURGH TRAMWAY ESTIMATES.—Edinburgh Tramways Committee have approved the estimates submitted by the general manager (Mr. R. S. Pilcher) for the period from June 30 this year, when the Corporation takes over the working of the tramways, to May 15 next year. The total expenditure is estimated at £329,225, and the total revenue at £401,855, leaving a balance of £72,630, which will be required for interest and sinking fund contributions.

PORTSMOUTH CORPORATION TRAMWAYS.—The tramway accounts show an income of £121,047, and a gross profit of £33,024. There is a net profit on the undertaking, after payment of all charges, of £10,679. The Tramways Committee have retained £6,000 as a working balance, and have allocated £4,679 to the reserve fund. The number of passengers carried was 28,438,343, against 26,187,549. These figures do not include 43,600 wounded soldiers carried free.

SOUTH SHIELDS BOROUGH TRAMWAYS.—The report for the year 1918, presented by Mr. J. C. Whiteley, manager of South Shields County Borough Tramways, shows a total revenue of £51,726, an increase of £7,288 over 1917. Working expenditure is £38,726, an increase of £3,040, but the total includes £5,344 reserved for repairs to permanent way, overhead equipment and rolling stock. After paying interest on capital, etc., £5,864, and contribution to sinking fund, and various repayments, amounting in all to £4,198, there remains a balance of £4,350, which is to be given in aid of rates.

TYNEMOUTH AND DISTRICT ELECTRIC TRACTION COMPANY.—The report for the year ended December 31 last shows that the total revenue for the year amounted to £25,552, an increase of £4,263 over 1917. The expenditure, including a provision of £2,067 for renewals, was £17,985, an increase of £6,512 as compared with the previous year. The surplus on the year's working is £7,566, making with £612 brought forward from the previous year a total of £8,177. The amount is to be appropriated as follows:—To reserve, £1,000; to 5 per cent. dividend on the preference shares, £1,525; to 8 per cent. dividend on the ordinary shares, £3,712; to next account, £1,940.

RHONDDA TRAMWAYS.—The gross revenue of the Rhondda Tramways increased from £82,225 to £98,862 for the year 1918, and the number of passengers carried rose from 12,865,806 to 13,926,707. Operating costs fell from 77·14 per cent. to 73·09 per cent. There is an available balance of £34,733. Deducting rent paid to the Rhondda Council, depreciation, debenture interest, and reserves, the balance is £17,044. The directors propose to add £10,000 to the reserve for renewals, bringing it up to £36,000, and to pay a dividend of 6 per cent. on the preference shares, 4 per cent. being the balance on account of 1913, and 2 per cent. on account of 1914, carrying forward £1,044.

LONDON UNITED TRAMWAYS.—On Tuesday, April 8, Mr. Justice Astbury sanctioned the scheme of arrangement and reduction of capital of the London United Tramways. Counsel stated that, after prolonged negotiations with local authorities, an Act of Parliament was obtained in 1918, whereby the times at which local authorities could compulsorily purchase was put into one date, namely, 1950, and the company was allowed to charge somewhat higher fares. By the reconstruction scheme, accepted by share and debenture holders, and now sanctioned by the Court, it is proposed to reduce the share capital from £2,500,000 to £656,250, divided into 125,000 preference shares of £5 5s. each, which were to be sub-divided into 21 fully-paid shares of 5s. each, and each preference share was to be converted into one ordinary share of 5s. The capital was thereafter to be increased to £1,619,250 by the creation and issue of 963,000 new £1 preference shares.

W. T. HENLEY'S TELEGRAPH WORKS COMPANY.—The report of last year shows a gross profit of £203,410. After deducting debenture interest and other items, and the amount written off for depreciation and repairs, and adding the amount brought forward (112,041), there is a total balance of £260,095. Allowing for income-tax, reserve account, dividend on preference shares, and interim dividend on ordinary shares, there is an available balance of £179,509. A final dividend of 2s. 6d. per share on the ordinary shares, less income-tax, making 3s. for the year, has been declared, and £7,500 is carried to the staff pension fund, leaving £122,009 to be carried forward. At the meeting Mr. George Sutton (chairman) said that the accounts dealt with trading during a year of war. After November 11 they closed as rapidly as possible the work which they were doing for the war, but they have been hampered in the execution of peace orders by the difficulties in procuring raw material, and by insufficiency of labour. While they were proposing a 15 per cent. dividend, it was less than 4½ per cent. on the actual capital employed in the business. He had sometimes thought that they might be withholding too great a proportion of the profits earned, but the security of capital had been their first object.

INCREASED FARES IN LONDON.

On Sunday, April 27, the higher scale of fares came into operation on all the London County Council tramway routes south of the Thames. About forty different services are involved, radiating from the four principal termini—Victoria, Westminster, Blackfriars, and Southwark Bridge—to most of the outlying suburbs south of the city. At present the general effect of the new charge has been to add a penny to each fare. All journeys beyond 1·5 miles, which formerly cost one penny, now cost twopence, the twopenny ride is threepence, and the passenger accustomed to paying threepence now finds he must pay out fourpence. It can be easily understood that the alteration has not been accepted without serious and widespread complaint. The penny stages are not reduced by half—in fact, the reduction amounts to less than a fourth; but the point at which each stage ends has been fixed with greater regard to distance than to popular topography. Nearly all the passengers, and even a few conductors, will take some time to find their bearings again. Meanwhile, the decline in the number of passengers is very marked. Probably this is partly the effect of resentment and partly determination on the side of the public to demonstrate the futility of the higher fares policy. After a few weeks numbers will no doubt resume travel by car, and the strangeness of the position will wear off. Judgment therefore on the L.C.C. policy must be suspended for a period.

OMNIBUS FARES.

Mr. Higham asked the Home Secretary in the House of Commons on May 7 if he had commenced his inquiry into the reason for the increased omnibus fares in London. Mr. Shortt replied that he had obtained full details from the London General Omnibus Company, and he proposed to submit them to an eminent accountant to report on the question whether the increase in fares was justified.

Relaying Tramway Rails in Aberdeen.—Dean of Guild Meff, convener of the Tramways Committee of Aberdeen Town Council, brought before a recent meeting of the committee the urgent necessity for relaying the tramway track between Union Bridge and Castle Street. This work, the convener explained, would give employment to a considerable number of men, as it would have to be expeditiously carried out. The matter was remitted to the burgh surveyor and the tramway manager, to bring up a report at the earliest possible date, with an estimate of the cost of the work.

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CONTRACTS AND ORDERS.

The J. G. Brill Company have received an order from Glasgow Tramways Committee for truck frames.

Reading Tramways Committee have recommended the purchase of five motor omnibuses, at an estimated cost of £7,750.

St. Helens Electricity Committee has accepted a tender for cable from the British Insulated and Helsby Cables Limited.

The British Thomson-Houston Company's tender for six electric cars at £10,308 has been accepted by the East Ham Tramway Committee.

The British Automobile Traction Company are to supply a motor chassis for a rail welding machine and tramway tower wagon for Reading Corporation.

Dick, Kerr and Company, Limited, are to supply ten new vestibule tramway cars, with equipments, at a price of £1,792 per car, exclusive of the truck, to Doncaster Corporation.

Edison Accumulators, Limited.—The tender of this company for a 3½-ton electrically-driven vehicle has been recommended for acceptance by a committee of the Luton Council.

G. P. Trentham, Limited, of Birmingham, have a contract with the East Ham Town Council for the reconstruction of permanent way to the value of £25,099, and for paving and concrete foundations for road margins at £18,222.

Bradford Corporation have accepted the following tenders:—Rails, Walter Scott, Limited; tie-bars, Bayliss, Jones and Bayliss, Limited; rail bonds, British Insulated and Helsby Cables, Limited; welded rings, clips, bolts and nuts, E. Longbottom; and round steel rods, Crossley and Davenport.

Glasgow Tramways Committee have accepted the following among other tenders:—Axles, Glasgow Railway Engineering Company, Limited; galvanised steel wire, Whitecross Company, Limited, Sir J. Stewart and Company, Limited; commutators, P. R. Jackson and Company; drop forgings for jacks, A. Harper, Sons and Bean, Limited.

John I. Thornycroft and Company, Limited, have received an order for six of their type "J" motor chassis from Southampton Corporation Tramways. Among a large number of other orders now being executed by the same firm for their type "J" chassis for public service vehicles are the following:—Six for the Great North of Scotland Railway, six for the Great Eastern Railway, eleven for the various branches of the Provincial Tramways Company, and ten for the Portsmouth Corporation, the latter to be fitted with double-deck omnibus bodies. Another order is from the British Automobile Traction Company, who have already purchased a large number of Thornycroft's type "J" chars-a-bancs chassis. With the exception of the orders from Southampton and Portsmouth, all the above are repeat orders.

The English Electric Company—in which, it will be remembered, are now consolidated the various interests of the Coventry Ordnance, Dick, Kerr, Phœnix Dynamo, United Electric Car, and Willans and Robinson Companies—has secured an order from the Huddersfield Corporation for a 5,000 KW. turbo-alternator set, speed 3,000 revolutions per minute; and another from the Nottingham Corporation for a similar turbo-alternator set of 3,000 KW. output, together with surface condensing plant and cooling tower. The latter contract also includes the supply of rotary converters and an equipment of Ferguson super-heaters to existing Lancashire boilers to secure economies in steam consumption with the new turbine. This plant will be installed in the two Nottingham power-stations, together with interconnecting E.H.T. switchgear and transformers.

SANDBERG'S "IN-SITU" TREATMENT OF TRAMWAY RAILS.

In the issue of THE TRAMWAY AND RAILWAY WORLD of April 11, 1918, a description was given of Messrs. Sandberg's patent process for hardening existing tramway rails in position without disturbing the rails or pavement.

At that date, with the exception of experiments on a small scale at Leeds, the only contract secured was on the Croydon Corporation Tramways. At the present time Messrs. Scholey and Company, Limited, 56, Victoria Street, Westminster, the licensees and contractors for the patent, inform us that they have contracts with the following tramways:—Birmingham, Liverpool, Croydon, Manchester, Glasgow, Bournemouth, and the Metropolitan (London). Repeat orders have been obtained from the Corporations of Manchester, Birmingham, and Croydon, and negotiations are being completed with a number of other undertakings.

We understand that the results obtained so far are most encouraging, and that there is definite proof that the treatment is successful in retarding, if not actually preventing, the development of corrugation.

The process has been introduced at a most opportune time, and apart from the increased resistance to wear, the mitigation of the corrugation trouble, and the prevention of battering at joints are considerations which appear fully to justify the cost of the treatment.

PERSONAL.

Mr. E. B. Wedmore has been appointed as Director of Research by the Electrical Research Committee.

Mr. John Moulds has been appointed assistant to the electrical engineer of Leicester, at a salary of £500 per annum.

Mr. A. S. Blackburn, electrical engineer of Sunderland Corporation, has been granted an increase in salary of £200, to £1,200.

Mr. Thomas Roles, city electrical engineer of Bradford, has been granted an increase in salary of £250, to £1,250 per annum.

Mr. H. E. Stilgoe, city engineer and surveyor of Birmingham, has been appointed engineer to the Metropolitan Water Board.

Mr. H. E. Ellis, borough electrical engineer of South Shields, has been appointed chief electrical engineer of Southampton Corporation.

Mr. A. T. Kellet has been appointed assistant permanent way engineer of Sheffield Corporation Tramways, at a salary of £400 per annum.

Sir John Aspinall, ex-general manager of the Lancashire and Yorkshire Railway, has joined the Board of the English Electric Company, Limited.

Mr. W. T. Robson, tramways manager and engineer of Southampton Corporation, has been granted an increase in salary from £500 to £700 a year.

Mr. W. J. Squires has been appointed chairman, and **Lieutenent-Commander A. Cooper Rawson** vice-chairman of the Highways Committee of the London County Council.

Mr. R. Q. Robertson has been appointed manager of White Motors and Accessories, Limited, in succession to Mr. W. J. M. Bell, who has severed his connection with the company.

Mr. W. A. Jones has resigned the position of charge engineer of Leyton Council on his acceptance of the post of general secretary of the Electrical Power Engineers' Association.

The many friends of **Mr. J. M. McElroy,** general manager of the Manchester Corporation Tramways, will be glad to learn that he has recovered from his recent illness, and has resumed his usual duties.

Mr. B. W. Sleight has resumed his duties as manager of the Carlisle Tramways Company, on returning from the army. He served in the Royal Fusiliers and King's Own Lancashire Regiment, and was severely wounded.

Mr. William Morris, of Messrs. Ashurst, Morris, Crisp and Company, has been appointed a director of the Anglo-Argentine Tramways Company, Limited, and **Mr. W. D. Dawes** has been appointed London manager and secretary.

Sir Auckland Geddes, Minister of National Service and Reconstruction, has resigned in order to accept the presidency of McGill University, Montreal, where he was Professor of Astronomy previous to the outbreak of war. He will, however, remain in this country until the autumn.

Mr. J. A. Raworth has been joined in partnership by Mr. Ernest W. Moss, who was for some years chief assistant to the late Dr. S. P. Thompson. He was also assistant to Mr. H. M. Hobart. The new firm will be called Messrs. J. A. Raworth and Moss, with head offices at Queen Anne's Chambers, S.W.

Mr. A. R. Fearnley, general manager of the Sheffield Corporation Tramways and motor department, has been retained by the Middlesbrough, Stockton and Thornaby Corporations to advise and give evidence in the negotiations and purchase of the Middlesbrough, Stockton and Thornaby Tramways by the three Corporations. The tramways are owned by the Imperial Tramways Company.

Mr. E. T. Brandon, electrical engineer of the Hydro-Electric Power Commission of Ontario, and **Mr. E. Buchanan,** local manager of the system at London, Ontario, are about to visit this country to interview British manufacturers, to study their methods, to let them know just what class of electrical material is required in Ontario, and to ascertain to what extent the manufacturers are prepared to compete in that province.

Sir Albert Stanley, President of the Board of Trade, in accordance with the doctor's orders, is not at present dealing with his official duties. In these circumstances Sir Auckland Geddes has undertaken the function of Acting President of the Board of Trade during Sir Albert Stanley's illness. The "Board of Trade Journal" recently stated that there is every hope and expectation that Sir Albert will shortly be fully restored to health and able to resume his duties as President of the Board of Trade, but it is reported that Sir Albert desires to retire from the House of Commons at the end of this session.

We regret to record the death of **Mr. W. B. Blake,** superintendent of the line of the Underground Electric Railways, which occurred on May 8 at St. George's Hospital, after an operation. Some weeks ago Mr. Blake, while directing the removal of a derailed car, fell and received a slight injury to his leg. Septic poisoning resulted, and it was necessary to amputate his leg. Mr. Blake, who was 55 years of age, went to the District Railway as a boy of 16. He had seen the traffic increase from 16 trains an hour in the old steam days to over 50.

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TRAMWAY AND LIGHT RAILWAY NOTES.

ABERDEEN.

MORE CARS REQUIRED.

At present Aberdeen Corporation Tramways department has 82 tramway cars, but the management has decided that, to provide for increased traffic and to meet emergencies, at least 100 cars are required. With characteristic caution, the Tramways Committee has authorised the construction of two cars only, in the hope that prices will fall while these are being built. Before 1914 a car could be produced for £800, and at present the cost is £2,400. For some time past the new cars required by the Corporation have been built in Aberdeen.

BARROW.

COMPANY EXTENDS OPTION TO PURCHASE THE TRAMWAYS.

At the recent meeting of Barrow Town Council, the question of purchasing the tramways undertaking which serves the town from the British Electric Traction Company, the present owners, was brought up. The option to purchase expired on April 10, but the company had agreed to extend the period of option for three months.

BELFAST.

CARS DAMAGED BY PASSENGERS.

At Belfast on April 14 three tramway cars bound for the shipyards were rushed by about three hundred people, who filled the cars to such an extent that they could not be moved. The crowd resented attempts to reduce the crowding, and the windows and woodwork of the cars were smashed. One of the cars containing about seventy men was finally started, and when it reached Musgrave Street Barracks it was surrounded by police. The men were removed and their names taken. Many protested that having boarded the car they were unable to leave it, and had nothing to do with the damage. The trouble appears to have arisen from passengers waiting for the last possible cars, as the tramway officials stated that many earlier cars left only partially filled.

BLACKPOOL.

PURCHASE OF BLACKPOOL AND FLEETWOOD TRAMWAYS.

The Corporation of Blackpool and the Fleetwood Council have agreed upon terms which will enable Fleetwood to exercise its option to purchase the portion of the Blackpool and Fleetwood tramroad in its district within a certain number of years. In the meantime Blackpool Corporation will acquire the whole undertaking and work it in connection with their system, thus giving a through route to Fleetwood.

BRADFORD.

NEW MOTORS ORDERED.

Bradford Tramways Committee propose to order 52 tramcar motors in addition to the 52 recently ordered.

BRISTOL.

OVERCROWDING IN CARS.

Bristol Health Committee, at a meeting on April 15, discussed the report of the Medical Officer of Health, advising that, as the death rate was becoming normal, the restrictions on public performances and overcrowding in tramcars should now be taken off. The committee agreed, however, that overcrowding in the cars was dangerous to health, and decided that the Town Clerk should draft a letter to the Watch Committee in that sense.

CARDIFF.

IMPROVEMENT IN SERVICE.

Step by step Cardiff tramway services are being brought back to pre-war efficiency. A short time ago improvements were made in the services, and since then additional cars have been put on to the routes to the centre of the city both early morning and late evening. Services now start at 5.10 a.m., from various outlying termini, with additional cars, and the running continues up to 11 p.m. Stopping places in abeyance during the war have now been restored.

CARLISLE.

CAR LICENCES RENEWED.

The Carlisle Watch Committee recently limited the tramway car licences to a period of three months, in order to see how certain improvements promised by the company progressed. The period expired at the end of the present month, and the General Purposes Committee, at a meeting on April 10, reported that the company were doing their utmost to improve the condition of the tramways. The Watch Committee accordingly agreed to continue the licences for a further period.

CROYDON.

WOMEN CONDUCTORS RELEASED.

Women conductors have now been all replaced by men on the Croydon Corporation Tramways.

EDINBURGH.

OVERHEAD TROLLEY SYSTEM ADOPTED, PRINCES STREET EXCEPTED —MOTOR OMNIBUSES TO BE PURCHASED.

The question whether the conduit system or the overhead trolley system shall be installed in Princes Street is a question which has been keenly debated in Edinburgh. Opinion among the deputation which visited London and Bournemouth recently was divided between the two systems. Mr. Pilcher, the general manager, in the meantime drew up another report on the question of the system of traction for Princes Street, and in this he reiterated his objections to the conduit system. He pointed out that the cost of providing pointsmen at the several junction points in Princes Street would be not less than £800 per annum, and he emphasised the greater risk of breakdowns owing to the climatic conditions than with the overhead system. The sub-committee of the Tramways Committee drew up a report, non-committal in character, making no definite recommendations, but on April 9, when the matter was discussed by the Council, the following recommendations for the future arrangements and reconstruction of the tramway system of Edinburgh were approved :—" That the overhead electric system should be adopted generally, subject to separate consideration being given to special parts of the city ; that Princes Street should be separately considered ; that preparations for conversion and reconstruction should be made at once ; that conversion and reconstruction should be carried out in sections, the first to be undertaken being the section from Pilrig to Liberton ; that tentative approval should be given to the extensions recommended in the tramway manager's report ; and that a number of motor omnibuses, not exceeding 15, should be acquired. As the tramway system passes into the hands of the Corporation on July 1, the present employees are anxious to know the conditions under which they will be taken over by the Corporation. The men have already resolved that they must be dealt with through their union and not individually.

GLASGOW.

TRAMCARS FOR REVELLERS—WOMEN DRIVERS RELEASED—EMPLOYEES ON COMMITTEES.

Early in the year a "Victory" Ball was held in Glasgow in aid of " Jock's Box," and the management had the enterprise to provide tramcars to take the dancers home in the early hours of the morning. The great convenience of the expedient having thus become evident, it is now quite the thing for organisations holding high revel till far on in the night to charter tramcars to carry their guests homeward. Promoters of pic-nic parties have also realised the value of the tramcars as conveyances, and the bookings for that purpose are reported to be numerous. Saturday pic-nics by tram would be immensely popular, but at present the adventure is quite impossible. Between 3,000 and 4,000 of the employees of the Glasgow Corporation Tramways have served with the forces during the war. Recently men have been demobilised at the rate of abour 50 weekly, and to reinstate these men in their former situations women were released on April 12 from the duties of motor drivers, and have taken up those of conductors. The women more recently added to the staft have been dismissed, but there are still a large number of women in the tramway service. Glasgow was the first tramway to employ women as drivers. Bailie Wheatley, a Labour member of Glasgow Town Council, has tabled a motion requiring that each standing committee of the Council shall include a number of members to be elected annually by the employees of the department controlled by that committee, such members to form at least one-third of the whole, and to have equal powers with the other members.

HALIFAX.

TRACK RELAYING AND THE PRICE OF RAILS.

Halifax Tramways Committee have received a letter from the Ministry of Labour stating that, having regard to the already serious state of unemployment in Halifax and district, and the prospect of a further increase as demobilisation proceeds, the Divisional Council for Demobilisation and Resettlement strongly urges the necessity of putting in hand public works with a view to absorbing unemployed labour. The committee passed the following resolution :—" That while this committee is desirous of carrying out forthwith the work of relaying the tramway track, the attention of the Municipal Tramways Association be called to the high price of rails and materials with a view to the appropriate Government Department being asked to fix a reasonable maximum price in connection therewith."

HULL.

REINSTATEMENT OF EX-SERVICE MEN.

At the meeting of Hull City Council, on April 3, Councillor Richardson proposed :—" That in the case of Corporation employees who on demobilisation are found to be physically unfit for the work previously performed by them, it be an instruction to heads of departments that work shall be found for these men which they are capable of performing either in the department previously employing them or by consultation with heads of other departments. That such employment shall be so arranged that the total of the men's wages, plus any disability pensions, shall not be less than the current wages for the work he was on prior to enlistment, and that it be an instruction to heads of departments to report any cases when they are not able to carry out the terms of the foregoing to the committee concerned as speedily as possible."

LIVERPOOL.

COMMITTEE TO VISIT AMERICA—NEW ROLLING STOCK—TRAMWAY TO BE PURCHASED BY CORPORATION.

The Liverpool Tramways and Electric Lighting Committee have selected by ballot the following members as a deputation to visit cities in the United States and Canada to study tramway and electric supply improvements :—Alderman Russell Taylor, chairman ;

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Mr. F. C. Wilson, chairman of the Sub-Extension Electrical Committee; Mr. W. A. Robinson, leader of the Labour Party in the Council; and Mr. David Jackson. Two members are to be added from the Health Committee. The deputation will be accompanied by Mr. J. A. Brodie, city engineer, Mr. Harold Dickinson, city electrical engineer, Mr. C. W. Mallins, general manager of the tramways, Mr. A. G. Smith, city lighting engineer, together with the committee clerk. Several members of the Tramways Committee have expressed their intention of accompanying the deputation at their own expense. The deputation will leave for New York on May 27. About 25 of the 100 new cars recently ordered will be delivered shortly, and the committee hope by midsummer greatly to improve the service. At a meeting of Liverpool City Council, on April 2, it was resolved to promote an Order under the Light Railways Act to purchase from the Lancashire Light Railways Company a length of three and a half miles of tramway between Knotty Ash and Prescot. The agreed price, according to Alderman Russell Taylor, was £18,000, but renewal of the track would cost from £27,000 to £30,000.

LONDON.

A Van Driver's Negligence.

Judgment was given in favour of the London County Council Tramways in the Clerkenwell County Court on April 7 in an action for damages for personal injuries sustained by a passenger who was thrown violently against a seat owing to the car stopping suddenly with a jerk. The judge held that the driver of the car was not guilty of negligence, as he had stopped the car to avoid a collision. He gave judgment against Messrs. Bushnell and Sons, carmen and contractors, against whom an action was also brought, ruling that the injuries were received by the negligence of their van driver.

NEWCASTLE.

Special Service at Special Fares—Appreciation of Employees' War Work.

Newcastle Tramways Committee have made arrangements to run special cars to meet the 11.30 p.m. train arriving from London. A special charge is made on these cars. To a deputation from the Newcastle Trades Council, asking for a better service of workmen's cars, the general manager pointed out that greater facilities could be provided but for the fact that the alteration of the hours in the factories brought them so close to the hours for ordinary traffic. The Tramways Committee propose to entertain the auxiliary tramway workers at a social gathering, in order that the committee may express their appreciation of the work done by these men during the war.

SHEFFIELD.

Music in the Parks—A Tax on Passengers.

Sheffield Tramways Committee propose to contribute £200 towards the cost of music in the parks. The *Sheffield Daily Telegraph* remarks that it has no great liking for these tramway contributions. They are useful when there is a doubt as to the legality of paying for anything from the rates, but it should be quite possible to pay for music in the parks as part of the ordinary maintenance charges. If that is not so, then the tramway's contribution will come in useful. If it is so, then it would be very much better that the cost of music in the parks came directly from the rates. It certainly is not just that tramway passengers should be taxed for luxuries.

STOKE-ON-TRENT.

Vestibules Wanted on Tramcars.

At a meeting of the Estates, Public Works, and Tramways Committee of Stoke-on-Trent Borough Council, the Town Clerk submitted a resolution of the N.S. Trades and Labour Council, calling upon the Potteries Electric Traction Company to provide vestibules on all cars on their services, and asking for the Council's support. The committee resolved to support the action of the Trades and Labour Council, and urged the company to provide such vestibules at the earliest possible moment.

WALLASEY.

New Cars to be Ordered—Motor Omnibuses Later.

Wallasey Tramways Committee are arranging for the purchase of ten new cars at a cost of £20,600, but they have postponed a decision of the question of obtaining motor omnibuses for six months. The Council hope they may then be able to obtain the vehicles at a lower price.

WEMYSS BAY.

Tramway Extensions Proposed.

A scheme is being discussed for linking up Wemyss Bay and Largs by an electric tramway. The distance is about ten miles, and as the roadway is practically level throughout, the route is well adapted to tramway construction.

WORCESTER.

Tramway Conductor's Responsibility.

At an inquest on a man of 74, who jumped off an omnibus before it had stopped, and was killed by being struck by a motor car, the coroner for North Worcestershire said that no blame attached to anyone, but the conductor ought to exercise discretion in looking after passengers. The conductor, in his evidence, had said that they were not supposed to hold back people if they wished to jump off. One of the officials said that they encouraged their conductors to caution any member of the public who might stand on the platform not to attempt to jump off before the vehicle came to a standstill. At the same time, they could hardly forcibly restrain any passenger who might wish to take the risk in jumping off. If they did so, they might be summoned for assault. If passengers deliberately disregarded warnings, they must take the consequences.

YORK.

Tramways Committee to Join National Industrial Council—Wages Raised.

After considering the constitution of the National Joint Council of the Tramway Industry (the text of which was published in our issue of March 13), York Corporation Tramways Committee has agreed to become a member of the Council. At a recent meeting of the Committee, the tramways manager, Mr. J. W. Hame, reported the result of negotiations with the tramway employees on the question of wages and hours of work. The committee have agreed to pay the employees a war wage of 30s. per week to a man who has worked his full six days or six shifts on rota duty, and an extra 5s. when he is required to work a shift on the seventh day, overtime to be paid on a certain hourly basis.

PATENT LIST.

Abstracted for "The Tramway and Railway World" from the Official Journal of Patents.

***** If the inventions have been communicated the names of the communicators are given in italics.**

Applications for Letters Patent.

The number of the patent is given in brackets.

Multiple control apparatus for electric railways with motor-driven main switch drums (8,200)—Akt.-Ges. Brown Boveri et Cie.
Self-propelled tramway and railway cars (8,368)—G. Ashton.
Rail joints (8,191)—H. V. Baints.
Mechanically-propelled vehicles (8,037)—E. W. Bonson.
Transmission gearing for power-driven vehicles (8,351)—E. W. Bowen and T. L. Davies.
Device for oiling and greasing motor vehicle road springs (8,088)—H. Capel.
Motor cars (8,071)—C. Contal.
Petrol tank for motor cars (8,588)—J. S. Haigh.
Brake actuated mechanism for tramway cars (8,122)—W. Heap.
Omnibus construction (8,625)—W. J. Hickman.
Steering and front wheel brakes of automobiles (7,995)—L. A. Higginbottom.
Radiators for motor vehicles (8,615)—M. F. Huxley.
Driving devices of motor vehicles (8,538)—O. Imray (*M. Walter*).
Locking device for motor vehicles (8,317)—H. Jenks.
Device for driving motor vehicles (8,372)—J. W. McKay.
Motor vehicle bodies (8,187)—G. Maddox.
Device to enable motor cars with broken rear axle to be driven on their own power (8,646)—G. S. Owen.
Station indicators for passenger vehicles (8,345)—E. Petitjean.
Resilient tires for motor vehicles (8,045)—A. M. Robinson.
Automobiles (8,192)—E. J. Y. Rutherford.
Change speed gearing (8,308)—A. B. Sanders.
Semi-solid resilient rubber tire for motor vehicles (8,614)—A. Tomlins.
Lines for light railways (8,232)—A. D. Watts and L. P. Watts.
Power Transmission mechanism of railway motor cars (8,718)—Baguley Cars, Limited, and E. E. Baguley.
Mechanically propelled vehicles (9,277)—L. Barrow, Cadbury Brothers and S. M. Scott.
Device for tramcar trolley poles (9,340)—J. H. Beabey.
Differential gear (9,390)—K. A. T. Berg.
Variable speed gear (8,843)—J. M. Carruthers and A. E. Cox.
Lifting jacks (8,957)—J. J. Culver.
Bodywork frames for motor vehicles (8,846)—Daimler Company and H. C. Inskeep.
Omnibuses, etc. (9,377)—C. Dodson.
Variable speed gear (9,286)—E. N. Gulick.
Mounting light steel flat bottomed rails upon steel sleepers (8,680)—S. Hemingway.
Combined pulley wheel and extension pieces for trolley pole of tramcars (8,823)—J. M. Hodges and A. Smith.
Electric signalling apparatus for cars on electric railways (8,877)—C. Kunzli and H. Schaub.
Variable speed gear (9,391)—R. Lindsay.
Locking device for motor vehicles (8,938)—G. E. Palmer.
Direction indicators for motor cars (9,158)—B. C. E. Parker.
Permanent way of railways, etc. (8,745)—E. A. W. Phillips.
Reducing speed gear mechanism (9,097)—A. R. Prentice.
Change speed gears (9,193)—T. A. Rees.
Means for steering and controlling motor vehicles (9,156)—L. Renault.
Safety guard for motor cars (8,724)—M. W. Robinson.
Electric vehicles (8,827)—W. Rogers.

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Electrically propelled vehicles (9,074)—J. Scott.
Friction change speed gears (9,371)—R. J. C. Tampier.
Automatic variable speed gear (8,862)—C. H. Winteringham.
Motor vehicles (9,872)—M. de Arrigunaga.
Speed indicators (9,711)—R. Berry and E. A. Lambert.
Compressed air brake apparatus for railway, etc., vehicles (9,777 and 9,778)—British Air Brake Company and J. W. Cross.
Means for actuating speed indicating devices, governors, etc. (9,486)—G. Constantinesco.
Coupling for trollies, etc. (9,493)—A. Devrin.
Method of attachment and springing of motor vehicle road wheels (9,674)—J. Dixon.
Light motor vehicles (9,606 and 9,607)—H. M. Edmonds.
Motor fore-carriages (9,863)—H. M. Edmonds.
Variable speed gear (9,852)—A. Elverston.
Tires of motor cars (9,706)—G. M. Handyside.
Signalling danger to vehicles at road junctions (9,698)—S. Horton, F. Whitworth and R. Willetts.
Electric signalling and indicating apparatus (9,443)—McKenzie, Holland and Westinghouse Power Signal Company and H. M. Proud.
Appliances for locking steering wheels of motor cars, etc. (9,574)—C. N. Neal.
Pneumatic tires for motor vehicle wheels (9,795)—R. P. Payne.
Change speed gear (9,844)—M. Rose.
Devices for locking motor cars (9,553)—T. A. Waters.
Variable speed gear (10,088)—H. B. Allen.
Hand steering wheels of motor vehicles (10,412)—Bluemel Brothers and F. H. Bluemel.
Motor vehicles (10,263)—R. J. Wainwright-Brown and G. de Holden-Stone.

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Change speed gears for motor vehicles (10,370)—F. Butler.
Device for locking motor vehicles (10,364)—W. E. S. Debenham.
Direction indicator for motor cars (10,384)—A. V. Grenville.
Driving mechanism for motor vehicles (10,383)—H. Singleton-Griesbach.
Regenerative braking system for electrically driven vehicles (10,096)—K. H. O. Lubeck.
Laminated springs of motor cars (10,286)—F. D. Madge.
Motor vehicles (10,354)—L. E. de Mole.
Clutches and variable, etc., speed mechanism (9,916)—T. J. Read and W. J. Read.
Power transmission mechanism for automobiles (9,943)—H. C. Reading.
Suspension of automobile vehicles (10,226)—A. A. Scott.
Mechanism for locking steering wheels and control levers of motor vehicles (10,119)—T. A. Waters.

SPECIFICATIONS PUBLISHED.

1916.

Motor vehicles (85—*124,450*)—R. F. Macfie.

1917.

Means for utilising the bodies of motor vehicles for the storage of gas (10,256—*123,777*)—W. H. Dunkley.
Solid rubber tires (18,450—*123,789*)—Dunlop Rubber Company and H. C. Young.
Clutches for use on motor vehicles (10,898—*124,226*)—J. E. Holt and W. Harpham.
Motor driven vehicles (19,182—*124,535*)—Portland Engineering and Traction Company, J. Williamson and A. E. Munby.

1918.

Radiators and adjacent fittings of motor vehicles (3,771—*123,809*)—G. F. Cooke.
Driving mechanism for the auxiliaries employed on motor vehicles (4,002—*123,824*)—R. W. Maudslay and Standard Motor Company.
Control for gas driven vehicles (4,021—*123,826*)—South Metropolitan Gas Company and R. C. Macdonald.
Change speed gears (4,193—*114,307*)—J. Klaus-Ott.
Signal devices for motor vehicles (6,327—*116,883*)—Benjamin Electric Company.
Road wheels for self-propelled vehicles (7,453—*123,891*)—C. W. Higgs and A. W. D. Gladwell.
Gas producer for use on motor cars (7,765—*123,894*)—A. E. W. Maseyk.
Differential gear for motor vehicles (17,479—*123,943*)—A. Franks.
Hubs for use with motor vehicles (17,618—*123,945*)—R. J. Treen.
Apparatus for grinding tramway rails (21,361—*123,964*)—W. L. Lorkin.
Boarding tramcars (2,347—*124,011*)—H. A. Hunt.
Variable speed friction device (7,143—*124,097*)—R. Lowe and E. Wainwright.
Variable speed and reversing gearing (14,760—*124,148*)—J. J. Robinson.
Variable speed gear (18,175—*124,159*)—Crossley Motors, Limited, T. D. Wishart and T. N. Harrop.
Arrangement of fuel containers and instrument boards of motor vehicles (622—*119,024*)—E. H. Belden.
Lugs for power plant support for motor vehicles (6,984—*115,833*)—Hudson Motor Specialities Company.
Resilient means for automatically controlling the actuation of variable speed and reversing gearing and application thereto (7,918—*124,323*)—G. Rogers.
Fluid pressure braking apparatus (10,036—*123,709*)—W. V. Turner.
Tramway point operating devices (17,986—*124,391*)—G. Hendriks.
Electrical signalling systems for use on motor road vehicles (18,088—*124,394*)—Naillik Motor Signal Company and J. P. Ogden.
Differential gearing (5,273—*124,563*)—A. T. Nogrady.
Devices for controlling the speed of automobile vehicles (5,437—*116,691*)—A. Gaillard.
Variable speed gears (6,107—*124,602*)—S. A. Bagley and T. Bransom.
Electro-magnetic brakes, etc. (7,164—*124,618*)—E. C. Villiers.

1919.

Reversing gearing (762—*122,634*)—A. A. Fernstedt.
Change speed gearing (4,298—*123,753*)—H. C. Blanc-Garin.

Report on Edinburgh Track.—Preliminary to taking over the tramways from the Edinburgh and District Tramways Company, on June 30, Edinburgh Town Council demanded that the track, which has fallen into disrepair, should be put into working condition. The company took the view that the Council's demands were excessive, and the matter was referred to arbitration. Sir A. B. W. Kennedy, the appointed arbitrator, has now issued his award. He finds that certain portions of the track must be relaid with new rails, and certain other parts with rails partly used.

A Halfpenny Saved on Returns.—The Sheffield Corporation Tramways and Motors Department has made arrangements whereby passengers travelling on the cars up to and including 9 a.m. on weekdays can obtain return tickets for the 1½d. fare stages at a cost of 2½d., thus effecting a saving of a halfpenny on the double journey.

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TRAFFIC RETURNS.

Tramway and Omnibus Undertakings in the United Kingdom.

NAME OF COMPANY OR CORPORATION.	1918. WEEKS ENDED.					1919. WEEKS ENDED.					AGGREGATE.		
	Mar. 30	April 6	April 13	April 20	April 27	Mar. 29	April 5	April 12	April 19	April 26	Wks.	1919.	Increase or Decrease.
	£	£	£	£	£	£	£	£	£	£		£	£
Aberdare U.D. Council	497	323	763	460	460	490	425	580	530	769	3	1,880	--
Aberdeen Corporation	2.257	2,279	2,265	2,160	2,192	2.546	2,567	2,898	2,892	3,091	47	122.721	+ 20,498
Ayr Corporation	366	492	367	364	416	422	530	478	544	754	48	28,195	+ 5.940
Belfast City	...	...	...	...	...	...	...	...	...	...	--	--	--
Birkenhead Corporation	1.959	2.042	1.894	1,876	2.073	2,243	2.392	2.353	2.398	2.530	3½	9.260	+ 1,413
Blackburn Corporation	1,601	1,441	...	...	2 374	1.881	2.086	2,269	1.989	3,873	4½	10.217	+ 3.332
Bradford Corporation	7.283	6.309	7.665	6,705	7.527	9,601	7.741	10,203	11,395	13.612	4	42.951	- 12.896
Burnley Corporation	2.444	2,139	2.014	1.863	2,115	2.729	2.701	3.003	3.681	3.529	--	--	--
Burton-on-Trent Corporation	383	406	361	385	377	405	401	404	499	502	4	1,748	+ 282
Bury Corporation	1.981	1.783	1.626	1.554	1.879	1.962	1.945	2.176	3.052	2.749	3½	9.823	+ 2.981
Chatham and District	1.290	1.342	1.168	1.137	1.170	1.246	1.308	1.418	1.499	1.794	16	20.735	+ 1.637
Cork Electric	669	621	623	589	495	501	558	619	632	710	16	8.996	- 614
Derby Corporation	1.356	1.458	1.279	1.284	1.440	1.448	1.527	1.518	1.709	1.798	4	6.318	+ 857
Dundee City	1.532	1,687	1.513	1.606	1,538	2.024	2.050	2.183	2.201	2.380	49	97.124	+ 20.075
East Ham Corporation	1.404	1.353	1.268	1.187	1.288	1.688	1.704	1.827	1.948	2.020	3½	7.064	+ 2.361
Glasgow Corporation	27.691	28.475	28.122	28.263	28.659	29,789	30.419	31.211	30.938	33.353	47½	1,360.179	+ 103.368
Glossop (Urban Elec. Supply Co.)	204	195	171	160	175	208	215	225	264	259	17	3.726	- 693
Halifax Corporation	2.548	...	2.376	2.204	2.227	2.495	...	3.080	3.037	5.268	3½	11.761	- 3,501
Halifax Corp Motor Omnibuses	56	...	53	51	52	56	...	71	73	109	3½	264	- 80
Huddersfield Corporation	3.307	4.400	3.173	3.062	3.441	3.796	3.911	4.345	4.633	6.392	4	19.282	- 5.205
Ilford U.D. Council	839	997	899	876	871	1,047	1,072	1.123	1.225	1.254	4	4.418	- 1.087
Ipswich Corporation	686	771	617	602	662	637	690	747	901	896	4	3.081	- 654
Isle of Thanet	218	286	212	177	220	343	530	562	978	1,079	29½	11.193	+ 5.758
Kilmarnock Corporation	235	249	238	223	239	264	264	288	286	320	49½	13.302	- 2.854
Lanarkshire	3.463	3,732	3.547	3.519	3.575	3,577	3.595	3,871	112	861	16	53,006	665
Lancashire United	...	...	...	...	...	...	...	...	...	...	--	--	--
Leeds City	11,454	12.824	10,713	10,736	11,411	14.312	14,915	15.334	16.187	20.226	4	63.111	- 22.230
Leicester Corporation	4.436	4.765	4.101	4.211	4.235	5.148	5.207	5.847	5.776	6.365	--	--	--
Leyton U.D. Council	1 921	2.096	1.858	1.919	1.766	2.636	2.608	2.807	2.903	3.723	4	12.041	- 4.502
Liverpool Corporation	17.198	17.784	16.736	16.557	17.415	21.698	21.354	22.329	22.520	24.173	16½	342.692	- 65.082
Llandudno and Colwyn Bay	327	537	325	315	332	313	346	385	467	819	21	7.039	- 1,399
London County Council	56.073	57.285	55.333	55.324	54.253	71.085	70.763	74.928	75.104	82.637	3½	253.209	- 71,852
Maidstone Corporation.	263	378	262	231	237	274	394	321	321	405	3½	1.441	- 332
Manchester Corporation	24.365	24.664	23.311	22.950	24 520	27.650	28.065	29.419	31.138	27.024	4	115.647	- 22,633
Newcastle-on-Tyne Corporation	8.805	8.788	8.551	8.460	8,787	8.478	8.607	8.960	9.289	7.487	4	34 343	- 2.246
New St. Helens and District	...	...	...	...	...	...	...	...	...	...	--	--	--
Northampton Corporation	...	778	869	881	873	...	619	1,152	1,265	1,522	4	4,558	- 1,157
Nottingham Corporation	5.150	5.933	4,948	5,156	5.311	6.611	6.789	6.731	7,231	7.983	4	24.747	- 6.008
Oldham Corporation	...	...	...	...	...	...	...	...	...	...	--	--	--
Reading Corporation	1.253	1.223	1,164	1,157	1,176	1,339	1.365	1.515	1.551	1,633	3½	5.295	- 1,272
Rhondda Tramways	...	...	...	...	...	...	...	...	...	...	--	--	--
Rotherham Corporation	2.168	2.124	1.954	1.988	2.094	2.119	2.142	2.165	2.863	2.362	4½	10.015	+ 1.156
Sheffield Corporation	12,784	13.883	12.717	12,688	13.637	16,072	16,725	16,704	17.215	18,231	4½	80.163	+ 18.331
Southampton Corporation	2.362	2.613	2.364	2.274	2.344	2.407	2.476	2.578	2.538	3.181	3½	9.052	- 813
Southend-on-Sea Corporation	707	...	691	676	677	1,145	...	1,372	1,403	2.689	4	5.835	+ 2.306
South Shields Corporation	1.132	1,179	1.031	1.010	1 059	1.234	1.248	1.342	1 479	1.601	4	5.358	+ 1,419
Sunderland Corporation	2.020	2,179	1.981	2.038	2,069	2.694	2.498	2.731	2.974	3.080	4	11.283	- 3.015
Swindon Corporation	301	...	298	266	279	264	...	286	295	438	3½	1 097	+ 172
Torquay Tramways	820	979	796	708	785	752	830	919	907	1,507	16	13,030	- 1 473
Tyneside Tramways and Tramroads	1.012	1.116	909	871	908	884	884	984	964	1 618	17	14,526	+ 304
Wallasey Corporation	1.648	1.846	1.511	1.481	1.615	2.040	2.111	2.247	2.477	2.958	3½	9,308	- 3.026
Walsall Corporation	1.387	1.451	1.070	1.096	1.114	1.310	1.315	1.337	1.405	1.800	5	5.519	+ 949
Walthamstow U.D. Council	1.321	1.504	1.221	1.165	1.220	1.440	1.526	1.646	1.834	2.025	4	7.081	+ 2.516
Warrington Corporation	...	...	...	...	...	...	...	...	...	...	--	--	--
West Ham Corporation	3.905	4.184	3.797	3.845	3.781	4.813	4.884	5.193	5.334	6.271	3½	18.802	- 4.923
Wigan Corporation	...	...	...	...	...	...	...	...	...	...	--	--	--

*** A number of undertakings suspended the issue of traffic returns for the duration of the war.

Colonial and Foreign Tramway Traffic Returns.

NAME OF COMPANY.	1918. WEEKS ENDED.					1919. WEEKS ENDED.					AGGREGATE.		
	Mar. 30	April 6	April 13	April 20	April 27	Mar. 29	April 5	April 12	April 19	April 26	Wks.	1919.	Increase or Decrease.
	£	£	£	£	£	£	£	£	£	£		£	£
Anglo-Argentine	53.346	57.588	58.041	59.417	57.721	61.541	66,988	60.190	55,406	65.483	17	984,067	+ 46.393
Calcutta Rs.	66,690	70.023	73.597	73.362	71.869	81,666	85.553	75.391	79,416	80.494	16½	1,410,741	+201,016
Madras Rs.	...	...	...	(2 weeks)	42,911	...	...	...	(2 weeks)	44.706	17	271,568	- 49,156
Pernambuco	4,341	4,616	4,496	4.441	4,387	5.563	5,811	5,436	5.448	5,385	16½	89,803	+ 11,478

Companies issuing Monthly Statements only.

	1917.		1918.				1918.		1919.				Wks.	AGGREGATE.	
	Nov	Dec.	Jan.	Feb.	March.	April	Nov.	Dec.	Jan.	Feb.	March.	April.		1918-19.	+ or -.
	£	£	£	£	£	£	£	£	£	£	£	£		£	£
Ballarat & Bendigo	3.405	3,228	4.505	3,573	3.803	...	3.570	3,884	4.504	3,602	3,051	...	48	42.131	+ 1,444
Brazilian Trac. Mlrs	7695000	8069000	7837000	7315000	...	...	7581000	8531000	8522000	7972000	...	...	8	16494000	+ 1,342.000
Brisbane	32.901	35.019	34.500	...	...	...	39.246	38.135	38.575	...	...	...	4	38.575	+ 4,075
British Columbia	$ 525.629	555,555	559,569	501.150	510.892	...	612.893	691.065	667.489	645 415	649.120	...	38	5.390.119	+ 894.948
Buenos Ayres L'c'z.	39,678	40.901	38,902	34,397	42.647	41.643	42,952	50.460	41.556	42,429	47.370	43,607	43	434.186	+ 46.122
Burma	27,760	26.224	25,430	22,985	27,906	...	34.407	34,593	38,265	35,926	38,440	...	34	289,170	+ 77,029
Cape Town	16.522	...	...	...	...	...	18.385	...	...	...	...	...	--	--	--
Carthagena & H.	3,932	4,424	4.011	4,031	5.316	4,200	2,988	2,950	3.655	2,351	2,400	1,786	17	10,192	- 7,366
Cordoba	...	...	12.844	...	...	...	...	...	13,942	...	...	...	44	145.654	+ 10.915
East India	871	1.099	1,176	1.318	1,729	1,791	1.947	2.048	1,970	1,689	2.016	1.920	38	17.548	+ 5.261
Kalgoorlie	2,641	3.044	...	...	...	...	2.933	2.848	...	...	...	...	52	33.686	+ 1.078
La Plata	3.742	4.606	4.711	4.746	5 348	5.169	5.334	5.792	5.730	5.698	6.592	5,530	17	23.650	+ 3.677
Lima	37,249	43.198	43.561	41.921	...	...	44,948	47,887	45.362	46.082	...	...	8	91,444	+ 5,962
Manaos Rs.	...	...	...	...	...	...	...	...	...	...	...	...	--	--	--
Manila	$ 159,000	169,000	167.000	...	...	...	214,292	236,612	231,585	...	...	...	52	2.326.884	+ 525.609
Monte Video	...	34.025	36.016	34,573	36,659	...	...	38.441	40.910	38.772	41.070	...	21	190 891	+ 18.558
Peruvian	$ 999.680	1101090	1189350	925.410	...	...	897.090	1057990	1009650	943,470	...	...	34	7,973,835	- 229,195
Para	...	23,315	24,060	22,198	24,848	...	...	23,800	24,515	23,248	26,022	...	17	97.585	+ 3,164
Port Elizabeth	3.807	...	...	...	...	...	3.498	...	...	...	...	...	--	--	--
Rangoon	5,358	5.438	5.361	5.662	5.955	5,885	6,611	6,188	6.373	5.694	7.533	6.217	17	25.817	+ 2.954
Toronto	$ 1052000	...	1068319	981.933	1113472	...	1071106	...	1106840	1015797	1083285	...	13	3.205.922	+ 42.198
Winnipeg	$ 305.881	...	334 642	298,899	307.289	...	283.721	...	390.539	371.162	384.937	...	13	1,146.638	+ 205.808

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Outlying districts, badly served by railways, have always been a trouble to manufacturers by reason of the delay caused in making deliveries.

Traders recognise more and more that delivery time is a serious item of expense. Goods lying in trucks in railway sidings are so much dead capital—a few days saved on a number of consignments will easily pay the interest on the investment of a Daimler Commercial Vehicle.

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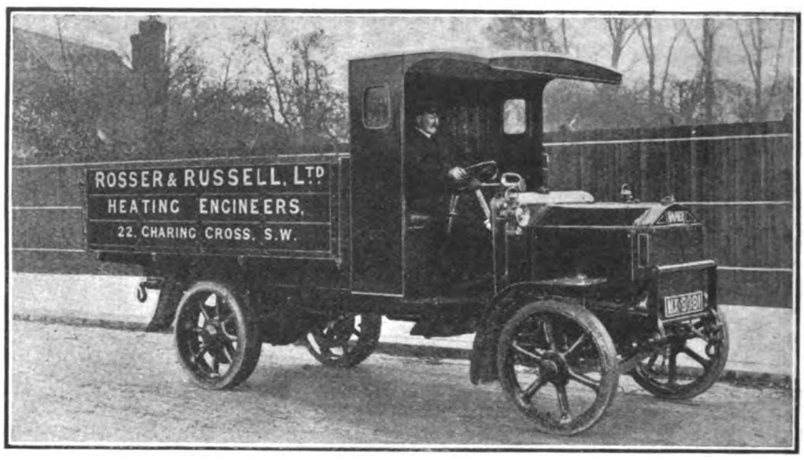

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RELIEF AT LAST.

The concessions granted by the Chancellor of the Exchequer in his Budget affect both the motor manufacturer and the motor user in such a way that satisfaction has been expressed almost universally by those concerned. There is the more reason for gratification because this is not a period of general reduction of taxation. There is one other reduction, to which we shall presently refer, which favours the motor as well as other industries, but otherwise the changes in taxation are in the upward direction. Another kind of spirit—the alcoholic brand—has been subjected to a further large increase of taxation, but it is still permissible to hope that in the future large quantities of it will be available duty free for use as motor fuel. Meanwhile, under the present Budget, we have the removal of the petrol licence, the reduction of the tax, and the release of benzol from all taxation. Though benzol by itself is not in first rank favour in motoring quarters, it can in any case be used in conjunction with petrol. It is understood that large stocks of benzol no longer required for the manufacture of explosives are available, and existing facilities for the production of this fuel on a large scale can if necessary be maintained. With the concessions now made, the demand for all sorts of motor vehicles is bound to be stimulated, and it may be some time before manufacturers can fully meet it. What is wanted at the moment is the release for civilian purposes of the great number of heavy motor vehicles in the possession of the military authorities and now no longer required by them. Anything in the shape of an omnibus, or any chassis which would be suitable for an omnibus body, will be welcome both to the omnibus owners and to the general public in London, where the congestion of public service vehicles becomes more and more intolerable.

EXCESS PROFITS.

The reduction of the excess profits tax from 80 per cent. to 40 per cent. will be specially welcome to motor vehicle manufacturers at a time when any special profits which accrue can be advantageously utilised for developing productive facilities. The more effectively the manufacturers are able to meet new demands for commercial and pleasure vehicles the greater are, or should be, their profits, and a respectable modicum of these over what they made in 1913 should be left in their hands, so that the money may be put into the business. That seems to be a better plan than raising or attempting to raise fresh capital. It has also to be considered that profits are subject to income-tax, if not taken away under the excess profits scheme, so that the State is not altogether a loser. The short-sightedness of the policy of the Parliamentary Labour Party cannot be better illustrated than by their objection to the reduction of the excess profits tax. It is, however, only one other example of their efforts to kill the goose which lays the golden egg. We are always hearing about education; what about an education campaign for instructing the Labour Party in economics?

THE SLOUGH MOTOR DEPOT.

It is gratifying to find, at the time of writing, that the public inquiry instituted by the Government—under pressure—into the circumstances of the inception and carrying out of the great motor vehicle repair depot at Cippenham, near Slough, has got fully started. We are at all events to have the full facts, and if there is any blame it can be properly apportioned. The subject of this depot and the enormous cost of it have been hotly debated in the House of Commons, more especially within recent months, when it became apparent that war exigencies were over. Some people wanted the enterprise to be abandoned altogether. Mr. Churchill, the Secretary for War, made a speech in the House which certainly put a more reassuring aspect on the matter than it had hitherto worn, and he advanced what appeared to be good reasons for completing the scheme on a somewhat smaller scale than that originally intended. In view of the general feeling, however, he was well advised to agree to a public inquiry. Pending the result of that investigation, we do not desire to express any definite opinion on the merits, but would say that the motor industry of the country will be at least as keenly interested in the conclusions arrived at as any other class of the community. Many members of that industry are interested because in normal times—and normal times are coming again—they will probably do a good deal of work in the repairing of motor vehicles.

PNEUMATIC TIRES FOR HEAVY VEHICLES.

In these days of high pay for labour increased interest is attached to the question of using pneumatic tires for heavy vehicles. Some years ago experiments were made with pneumatic tires both for omnibus and industrial work, and the trials are being revived now that the experience of the Goodyer Tire Company in

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MOTOR TRAFFIC

the United States have brought about a far more hopeful outlook. Given a suitable tire as the result of the improved conditions of manufacture now available in this country, it would not be a difficult matter to secure an increase of the speed limit of 12 miles per hour allowed for heavy vehicles, whether fitted with pneumatic or solid rubber tires. British makers and users will be interested in the conclusions on the subject that were recently placed before the Metropolitan section, Society of Automotive Engineers of the United States. Mr. B. B. Bachman's paper set forth that from the available data it would seem safe to say that pneumatics had become common and proper for vehicles up to 1,500 lb. capacity. From 2,000 to 3,000 lb. inclusive there is a strongly marked tendency towards pneumatics, and on 2 to 2½ ton trucks they are just making an appearance, though on the larger sizes there is no practical evidence available. Although large trucks of three, four, and five tons capacity had been fitted, the fact that the tire makers are not listing them would indicate that the innovation in those cases is still in the experimental stage. While admitting that some of the advantages claimed are so obviously correct as to need no discussion, Mr. Bachman asserted that other claims are open to considerable question. The claims of advantage which are made comprise reduction in mechanical repairs, increase in permissible speed, decrease in fuel and oil consumption, less fatigue for drivers, lessened wear of roads, and greater tractive facility. While reduction of mechanical troubles can be accepted as a fact almost without comment, a point to be considered is that although the net trouble is reduced, a proportion survives only changed in character, owing to the greater engine speeds attained when pneumatics are used. It will thus be seen that for the heaviest vehicles the change is not likely to be all plain sailing, but will entail a great deal of watchfulness.

ROADS AND ROAD VEHICLES.

A Plea for a Comprehensive Road Transport Policy.
From a Correspondent.

The Transport Ministry being now to all intents and purposes an accomplished fact, it would appear that the most useful course to take is to endeavour to indicate the lines of a constructive policy which would make the new Ministry a really efficient and beneficent guardian of road transport interests. The details of the Minister's policy as regards the roads themselves may at present be left to experts on that side of the question. It will suffice to say that a number of very admirable suggestions were contained in a lengthy letter from Mr. Rees Jeffreys published in the *Times* a few weeks ago. Among the points emphasised were the necessity for classifying roads and maintaining the higher classes of roads partially by means of State grants; the need for powers for limiting the minimum width of roads and making provision for widenings, so that when increased traffic makes these necessary they can be effected at a reasonable cost; the desirability of improving the quality of labour available for work upon the roads by increasing the remuneration and improving the status of the men so employed.

As regards the other side of the problem, that is to say, the use and construction of road vehicles, there is a great deal of work lying to the hand of the new Ministry. The law as regards the use of motors is at present in a very incoherent condition. It needs to be simplified and co-ordinated. The whole of the law should be contained in one Act, and should be made comprehensive to the average man without legal training.

From the very first the officials of the Transport Ministry must get clearly into their heads the fact that roads and road vehicles form in effect two portions of the same organisation. It is time that we got rid forever of the old idea that what was required was a compromise between two antagonistic interests; that all vehicle owners were desirous of using the roads freely, and that all road authorities were desirous of keeping down the cost of road maintenance and improvement. The fundamental fact which needs to be appreciated is that the cost of transport is made up of two main items, namely, the cost of running and maintaining the vehicle and the cost of maintaining and improving the track upon which the vehicle runs. The case is analogous to that of the railways, the financial results of which depend just as much upon the permanent way as upon the rolling stock. In all such cases there must be what might be called an internal clashing of interests. The particular department responsible for any one duty naturally strives to show good economy within itself, but above the departmental managers there must be a general manager whose business it is to see that a saving effected by one department does not involve an inevitable and much higher increased expenditure in some other department. It is no use to keep down the cost of maintaining our permanent way if by so doing we vastly increase the cost of carrying goods or passengers along it.

There are presumably very few people who would deny that road improvement is needed, but there is distinctly room for diversity of opinion as to the ultimate purpose of that improvement. In some quarters it would be argued that the object is, by a capital expenditure in the first instance, to reduce the subsequent annual cost of maintenance. Others, whose reasoning is more sound, would regard the purpose of road improvement as being identified with improved economy in transport upon the road, and only in a secondary degree designed as a means of reducing the cost of road maintenance. The whole thing comes down to the question of whether, when roads have been improved and strengthened, advantage should be taken of the fact to give increased facilities for transport by means of road vehicles, or whether all the old limitations shall be maintained so as to economise on the roads themselves while limiting the efficiency of the vehicles to a very serious extent. In the opinion of the writer, every stage of road improvement should be marked by an equivalent withdrawal of restrictions upon the use of roads. In other words, if we have stronger roads with better services we can, without actually increasing the cost of road maintenance, permit higher speeds and higher axle weights to road transport vehicles. The work that a vehicle can do in the course of a day is proportional to the produce of its useful load into its effective speed. By increasing either load or speed we increase working capacity. In other words, we provide the driver with a more efficient machine, and consequently we increase the driver's output. Progress in any industry depends upon our ability to increase the output of the individual worker, and the importance of doing so becomes greater and greater as the worker realises his right to receive decent remuneration and to work under decent conditions and for reasonable hours.

We know that a strong and well-made main road, built in the light of modern knowledge, will certainly suffer less from the passage of a vehicle at fifteen miles an hour than would an inferior local road from the passage of the same vehicle at ten miles an hour. The moral is that we should use road improvement as a means of enabling us to render road traffic more efficient. It does not follow that this can best be done by increasing speed limits. Possibly the desired results should be rather obtained by increasing axle weights. The two processes are, however, closely interconnected. If we increase the limit of axle weight for vehicles permitted to travel at a given speed, we are in effect introducing into each category vehicles which hitherto were limited to a lower speed. If we could so far improve our roads as to make it possible to increase the axle weights of vehicles coming into every category by 50 per cent., we should thereby have reduced very largely the cost of transporting a given load over a given distance. An increase in axle weight would in almost every case mean a considerable increase in the percentage of the total weight represented by useful load. If we could carry, say, eight tons instead of five tons on the heaviest type of motor vehicle, the consequence would be to reduce the cost per ton mile by something like 35 or 40 per cent. The same effect could be produced all down the line, and in this way enormous aggregate savings would be effected. The trouble is, of course, that these savings are not apparent in any big national balance sheet. The consumer ultimately pays the cost of transport, and the saving would only be realised inasmuch as it would decrease the cost of living of the consumer, that is to say, of the whole community. On the other hand, a saving in road maintenance costs can be shown in an annual statement. An economy of this kind is obvious, and the man who can effect such an economy has an apparent claim upon our gratitude. Thus, the temptation is always in the direction of saving in road maintenance rather than in vehicle operating

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costs, and a very broad point of view must be established before this tendency can be counteracted.

Anot er big opportunity for economy capable of being realised by a judicious change in the law is to be found in connection with the use of trailers. At present the legal speed limits are such that the employment of a trailer behind the average motor vehicle actually reduces its daily working capacity. Thus, the use of trailers even where they could be drawn with ease and advantage, is definitely discouraged. So also is any serious attempt to overcome the opposition that can certainly be levelled against trailers of the ordinary type. The law admits no distinction between the ordinary trailer and any improved, safer, and more manageable variety. To get rid of the inherent disadvantages of the old trailer method must almost certainly involve some degree of complication which must in turn put up the cost of the vehicle. If the law offers no compensating privileges, it stands to reason that any attempts at improvement are practically certain to be nipped in the bud.

THE BUDGET AND TRANSPORT.

IMPORTANT DECISIONS OF THE CHANCELLOR.

In the course of his Budget speech on April 29, Mr. A. Chamberlain, Chancellor of the Exchequer, said :—I come now to motor spirit. The duty was imposed by the 1909 Budget. The full duty was 3d. per gallon, raised in 1915 to 6d. for cars used for private purposes. Cars used for trade or husbandry, doctors' cars, cars of veterinary surgeons, and cars used for professional purposes are all entitled to a rebate, while fire engines, certain other cars, stationary engines, and aeroplanes are entitled to motor spirit free of duty. In 1914 about 47,000,000 gallons paid full duty, over 40,000,000 gallons half duty, and about 8,000,000 gallons were delivered free of duty. A tax of that character is open to serious objection. It is complicated, and therefore it is expensive to administer and collect, and its dutiability is not in the nature of the article, but in the use to which it is applied. The same spirit exactly is dutiable if used for one purpose and not for another. The machinery for the collection of the duty provides that the duty is to be collected on all, and repayment made where the user is entitled to the abatement. In practice, though the extreme inconvenience is overcome by large users like the London General Omnibus Company, an irritation is set up which is correlative, not to the value of the tax so much as to the trouble of investigating the various claims. The committee will observe that in a tax of that kind, collected in that way, there is a wide opportunity for evasion and fraud. (Hear, hear.) I think there would be a great deal to be said for levying a charge, whatever it might be, on users of motor cars in forms other than a tax on petrol. But a satisfactory scheme of licences could only be worked out after careful investigation.

Before I formulate any scheme I wish to have the assistance of the Minister of Ways and Communications, and I propose to discuss this question with him between now and the next Budget, and I hope that on the next Budget I or my successor will be able to make proposals to the Committee. (Hear, hear,)

There are two points on which I must say something at once. The first relates to the existing excise duty on motor spirit. That duty brings only a trifling sum—£50,000 a year—and is derived almost entirely from Scotch shale oil. But a difficult position has lately arisen with regard to benzol manufactured in this country. Before the war benzol was a spirit experimentally used for driving motor cars, but was not taxed when so used. The war changed the position. During the war the production of benzol for war purposes, stimulated by the Munitions Department, developed with remarkable results, and there is now in existence a large manufactory with a very large stock of spirit no longer required by the Munitions Department, and which has a large output of something like 70,000 tons; and the Petrol Control Committee undertook to release this for the use of motor car users. But then the Board of Customs and Excise thought it to be their duty to step in and to issue a warning that benzol so used would be subject to taxation. Here we have the case of an industry found vital during the war, created and stimulated for war purposes, practically created at the Government's instigation and under Government guidance, which industry is threatened with the loss of its market owing to the cessation of war. That is not all. Benzol is not only important to the nation as an additional indigenous source of supply of motor fuel, but it is a very important ingredient in dyeing, an industry the growth and establishment of which in this country we have done everything to promote. (Hear, hear.) Under the circumstances, and acting on the advice of the Board of Trade, I propose to give legal authority to the exemption of benzol from taxation. (Hear, hear.) There is yet another subject connected with motors, the motor spirit licence. (Hear, hear.) That was imposed as a war measure to restrict the use of private cars at a time of shortage. The revenue was purely secondary. The necessity for the restriction has now gone. It was collected by a department of the Board of Trade. That department, which, I think, did its work extremely well, will be dissolved by May 17, and I am told that if we dissolve it we shall enable the Board of Trade to put an end to the employment of the department, with its 300 officials. (Applause.)

THE "STEVENS" PETROL-ELECTRIC VEHICLE AND ELECTRIC WELDING.

A demonstration of the capabilities of the "Stevens" 3-ton War Office subsidy petrol-electric vehicle in supplying current for electric welding was given before a company of Press representatives recently at Messrs. Dennis Brothers' works, Guildford. The welding equipment used was that supplied by the Quasi-Arc Welding Company, of Laurence Pountney Hill, Cannon Street, E.C., and the demonstration included a wide variety of welding operations, all of which were executed in a most satisfactory manner and with remarkable rapidity. These included the building up of a solid feather on a piece of heavy shafting, the building up of a worn key-way on a heavy mild steel casting, and a number of other operations which clearly indicated the great value of a mobile plant which made such repairs possible to machinery and structures in position. A special feature of the demonstration was the fact that when working at 105 volts two separate and distinct welding equipments could be operated at the same time from the same generator, and further, that by means of an appliance recently developed by the Quasi-Arc Company, it has been found possible to work efficiently at 60 volts, which means that three separate welding plants can be run simultaneously.

After the welding demonstration was completed, the company were given an opportunity of testing the running capabilities of the "Stevens" machine in the hilly district which surrounds Guildford, and although the trip was made in an ordinary standard War Department lorry, the universal opinion was most favourable as to the smoothness of the running and the excellence of the control under all conditions of speed and gradient.

IMPERIAL MOTOR TRANSPORT CONFERENCE.

The Imperial Motor Transport Council, which organised the Imperial Motor Transport Conference, held in 1913, is in process of reconstitution, with a view to the organisation of further conferences in the near future. Lord Inverforth, Minister of Supplies, has become a vice-president. New members of the Council include—

General Sir A. R. Crofton Atkins, K.C.B., and Colonel C. V. Holbrook, representing the Ministry of Supplies.

Brigadier-General R. Manley Sims, C.M.G., D.S.O., Agent-General for Ontario.

The Hon. Edward Lucas, Agent-General for South Australia.

Mr. C. S. Wade, Agent-General for New South Wales.

Lieut.-Colonel P. Pelletier, Agent-General for Quebec.

Sir John McCall, Agent-General for Tasmania.

Major-General Sir Newton J. Moore, K.C.M.G., M.P.

Mr. H. C. B. Underdown (president), and Mr. Bernard Caillard (vice-president), representing the Association of British Motor and Allied Manufacturers.

Mr. E. S. Shrapnell-Smith, C.B.E.; and

Mr. G. Holt-Thomas.

The headquarters of the Council are at the Royal Automobile Club. H.R.H. Prince Arthur of Connaught, K.G., K.T., is president, the Hon. Sir Arthur Stanley, C.B.E., C.B., is chairman, and Mr. Horace Wyatt is the organising honorary secretary.

OMNIBUSES AND GOODS TRANSPORT.

West Hartlepool and Walsall Corporations are promoting Bills to confer powers to run omnibuses within the boroughs and along specified routes. It is asked that the Corporations be empowered to convey goods as well as passengers. Walsall Council ask that all or some of the provisions relating to tramways, trolley vehicles, and omnibuses contained in the Acts and Orders of the Corporation be extended to and apply to the omnibus undertaking.

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DAIMLER 2-3 TON CHASSIS.

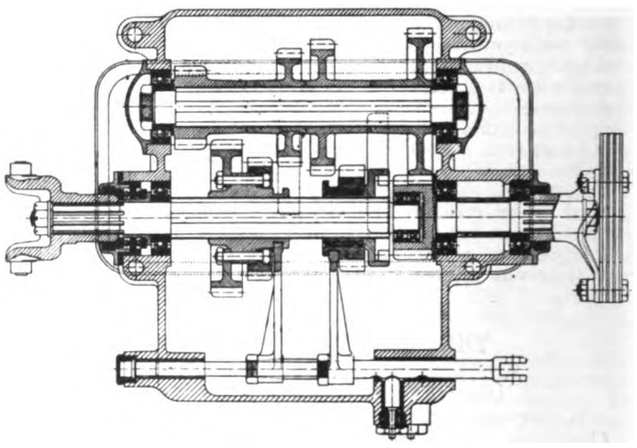
TWO TYPES FOR PASSENGER AND COMMERCIAL USE.

Considering that during the war the Daimler Company, of Coventry, were obliged to put their customers on a waiting list, which attained considerable length, the firm have not been an unreasonable time before inviting purchasers generally to give consideration to two of their post-war models. These have been admirably chosen from the point of view of what is likely to be the most general requirements for civil use. Further, the selected designs have the merit of suitability for two different classes of work, as demonstrated by the searching tests of war experience. These designs are the 2-3 ton chassis, which is produced in types CJ 22 and CK 22, of 11 ft. 6 in. and 13 ft. 6 in. wheel base respectively.

These lengths are suitable for lorry and wagon bodies, and for chars-a-banc and single-deck omnibus work. In both cases the 3-ton is inclusive of the body. There is a difference in the platform space (behind dashboard) which renders the second-mentioned model still more suitable for passenger work. While the platform space of the CJ type is 13 ft. 2 in., that of the CK type is 17 ft. 2 in., and the CK has a petrol tank of 20½ gallons capacity as against the 18½ gallons for the CJ. Beyond the foregoing item the two types differ but slightly. In each case the tank is fitted under the driver's seat, and the feed system is by gravity.

From the accompanying photographs and drawings the reader will be able to gather an idea of their merits. It speaks highly for the designers of the Daimler Company that the four and a half years of war service to which these models have been subjected have called for but few alterations or additions to the originals evolved in 1915. Practically the only important revision is to be found in the details of the transmission system; the other alterations are best described as refinements, which can be better appreciated by inspection than by description.

of frame, in which the members each consist of a wooden beam inserted between two steel plates, the combination then being rivetted together, as will be seen from two of the photographs.

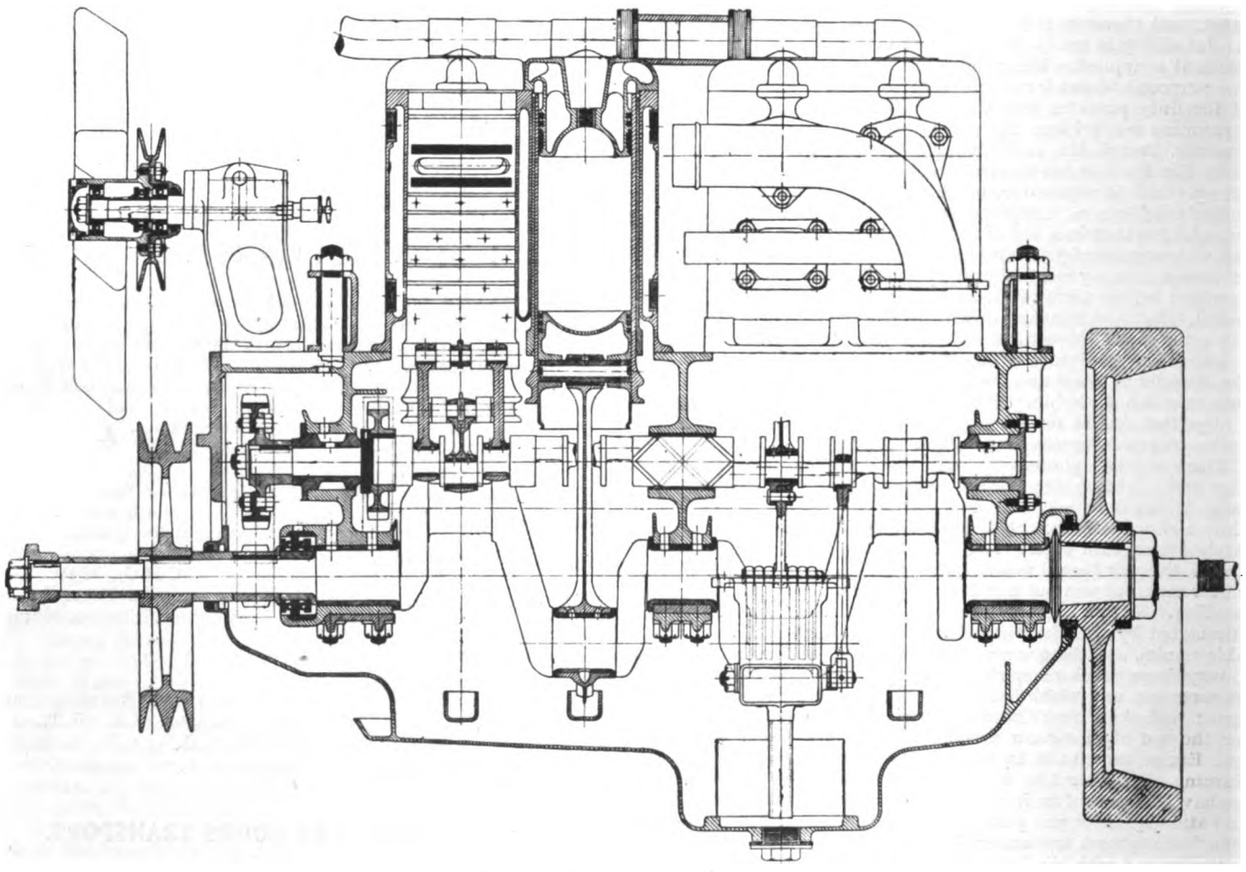


Sectional Plan of Gear Box.

To complete the description the chief items of the specification are given below:—

ENGINE.

4-cylinder Daimler sleeve valve (patented).
Bore—95 mm. (3¾ in.).
Stroke—140 mm. (5½ in.).



Daimler Sleeve Valve Engine.

The predominating impression which one gathers from the designs of these 2-3 ton chassis is the dual one of lightness and strength. These features may be described as the acme which builders of machines of moderate tonnage strive for. In this instance the attainment is assisted by the Daimler flitch plate type

Rating—22·4 H.P. (R.A.C. and Treasury).
B.H.P. developed—30, at 1,000 revolutions per minute.
Carburetter—Zenith. Ignition—Magneto. Lubrication—Trough splash, throttle controlled. Oil in base—2 gallons. Control—foot-operated accelerator pedal.

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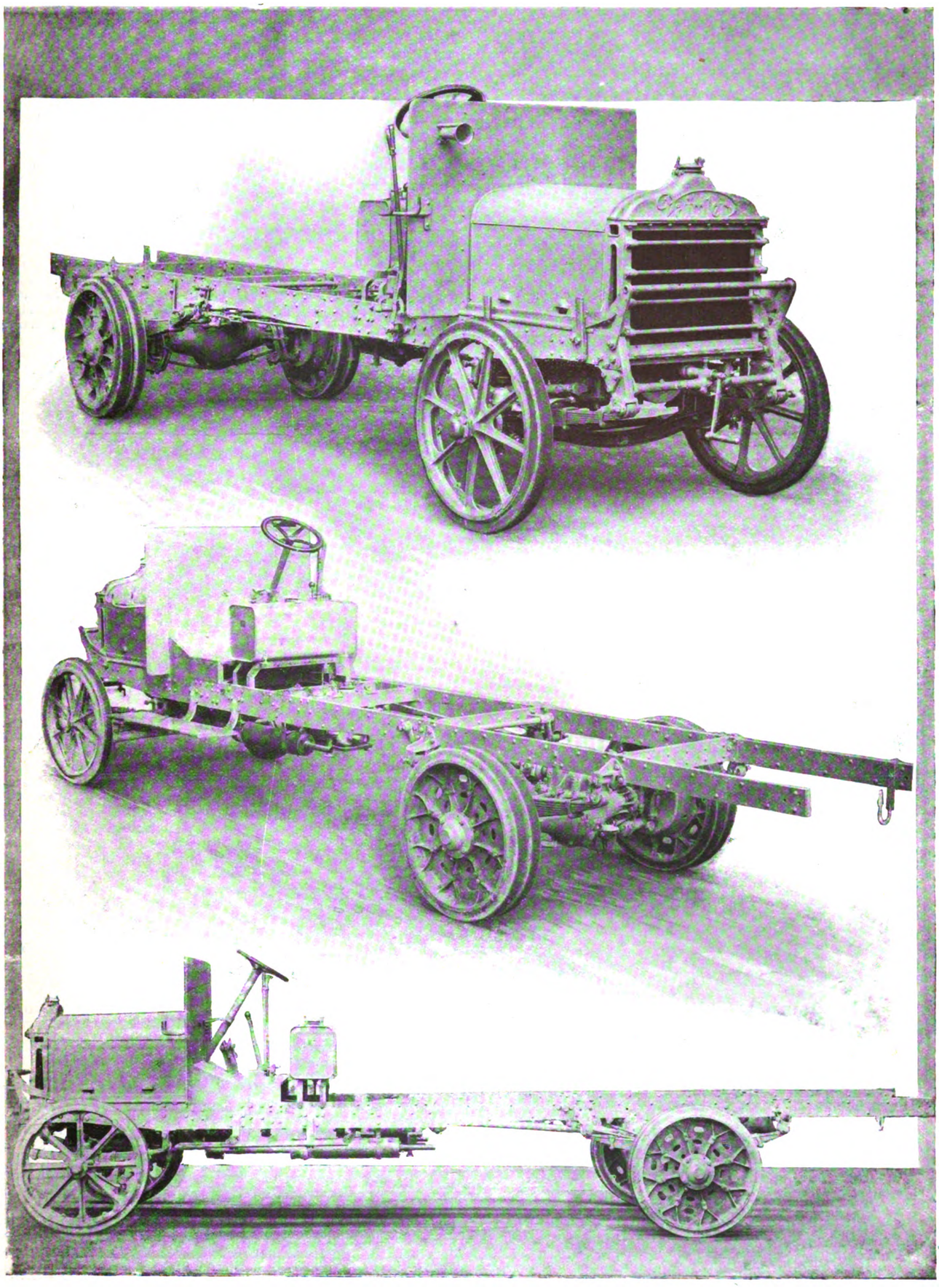

VIEWS OF DAIMLER 2-3 TON CHASSIS.

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TRANSMISSION.

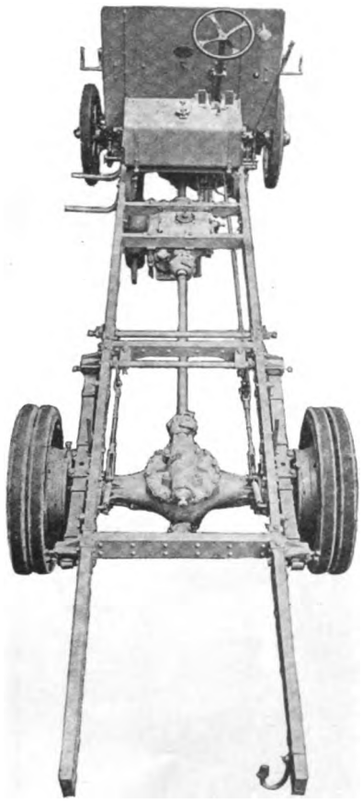
Clutch—Cone, lined with fabric.
Two leather couplings between clutch and gear box.
Sliding universal joint behind gear box } Roller bearings,
Universal joint in front of axle } universal joints.
Overhead Lanchester worm gear }
Ball bearings throughout, with rear wheels on Timken roller bearings.
Springs act as torque and radius rods.
Four forward speeds and one reverse.
Road speeds, at 1,000 revolutions per minute :—First, 3½ miles per hour ; second, 7 miles per hour ; third, 10 miles per hour ; fourth, 14½ miles per hour.

AXLES.

Front—I section, with wheels on bronze bearings.
Rear—full floating type.

STEERING.

Irreversible worm.



Rear View of Daimler 2-3 Ton Chassis.

BRAKES.

Hand and foot brakes—internal expanding type acting on rear wheel brake drum.

SPRINGING.

Front and rear—semi-elliptic.

RADIATOR.

Built-up type, with cast top and bottom tanks, and central assembly of gilled copper tubes. A substantial guard bar is fitted in front of radiator.

WHEELS.

Cast-steel, to take single tires on front and twin on rear. (771 rim diameter.)

TIRES.

Dunlop 900mm. 100mm. Single to front wheels and twin to rear. To suit 771 diameter rims.

CHASSIS WEIGHT.

Type CJ (11 ft. 6 in. wheel base)	49½ cwt.
Type CK (13 ft. 6 in. wheel base)	50½ cwt.

PRINCIPAL DIMENSIONS.

Wheel base—type CJ	11 ft. 6 in.
Wheel base—type CK...	13 ft. 6 in.
Wheel track	5 ft. 3 in.
Dash to centre of rear axle—type CJ ...	9 ft. 4 in.
Dash to centre of rear axle—type CK ...	11 ft. 4 in.
Centre of steering wheel to—	
Top of frame	39 in.
Dash	18 in.
Diameter of steering wheel	18 in.
Ground to top of frame (loaded)	32½ in.
Ground clearance (minimum)	9½ in.
Turning circle—type CJ	46 ft.
Turning circle—type CK	52 ft. 6 in.

It is important to note that the company provide a convenient method of attaching the various kinds of bodies. A further advantage is the means adopted for the suspension of the engine, which is consequently easy to remove in the event of repair being required. With the fourth speed put at 14½ miles an hour, an important step has been taken to preserve the life of solid tires and of the whole machine. With this reasonable maximum the makers are able to omit a governor as a standard fitting, thus lightening the fan driving pulley and facilitating the provision of electric lighting. The gross loaded weight of vehicle allowable is 5½ tons ; £950 is the price of the chassis, exclusive of various fittings of standard design. Orders are taken for delivery in June or July.

SCUNTHORPE OMNIBUS SERVICE.

The " Karrier " omnibus illustrated on the opposite page is the first of a series which Messrs. Witham and Chatburn, of Scunthorpe, propose to run. Scunthorpe is a small town which has recently come into notice on account of its valuable mineral products, and it has grown so largely within the last few years that, as in many similar cases, passenger transport has become a problem of urgent importance. Messrs. Witham and Chatburn have seen the possibilities and anticipate success from their undertaking. The omnibus left the Karrier Works, Huddersfield, on March 22, and was driven through to Scunthorpe on the full speed limit, accomplishing the journey in a very satisfactory way.

MAILS BY MOTOR VEHICLES.

Greater enterprise is being shown by the U.S.A. postal department in adopting motor vehicles than is the case at present with the British Post Office. Replying to a question in the House of Commons, the Postmaster-General, in a written answer circulated prior to the Easter recess, stated that the practicability of extending the use of motors for the conveyance of mails in rural districts was under consideration. As to the suggested use of motor cycles and sidecars, he understood that it was probable that such vehicles released from the army would not be suitable.

During the month of March 2,700 motor trucks were allotted by the U.S.A. War Department for rural postal work, and 1,000 to the Health Department for the conveyance of supplies.

For ten years past the British Post Office has had experience of the economy and despatch resulting from the carriage of parcels by motor contractors. This course was adopted in consequence of the high rates which the railway companies sought to impose.

ELECTRICS AND THE NEW MINISTRY.

Colonel Crompton, President of the Commercial Motor Users' Association, entertains great hopes of a more vigorous future for battery road vehicles when the electricity supply comes under the rule of the Ministry of Ways and Communications. Speaking at a meeting of the association, he said the Ways and Communications Bill had in a sense made possible certain dreams that he had put before the association, one of them being the great extension of the electrical supply of the country, so that they would be able to supplement the motor vehicle by the electric vehicle propelled by batteries. The inclusion of the electrical distribution on a national scale within the Ways and Communications Bill would be the means of cheapening road haulage in a manner which he did not think possible until he had looked into the question very closely.

It will be remembered that in Committee on the Ways and Communications Bill on April 8, the Home Secretary announced that for the present the Government intended to drop the proposal to include electricity supply in the Bill, and that they would endeavour to effect the inclusion when the measure for the control of electricity is introduced.

INQUIRY INTO LONDON OMNIBUS FARES.—The Home Secretary, in reply to a question by Mr. Higham, said he was making inquiries as to the increased omnibus fares in London, and the London General Omnibus Company had agreed to place the fullest information at his disposal. When asked by Mr. Higham why it was in the power of the Home Secretary to fix taxi-cab fares, while he had no power to fix omnibus fares, Mr. Shortt replied that it was because Parliament had so appointed it. Mr. Archer-Shee asked the Home Secretary if he would use his influence with the Board of Trade to have the whole question referred to a Joint Select Committee of both Houses, but no answer was given. A few days later Mr. Higham asked the Home Secretary if he had commenced his inquiry into the reason for the increased omnibus fares in London. Mr. Shortt replied that he had obtained full details from the London General Omnibus Company, and he proposed to submit them to an eminent accountant to report on the question whether the increase in fares was justified.

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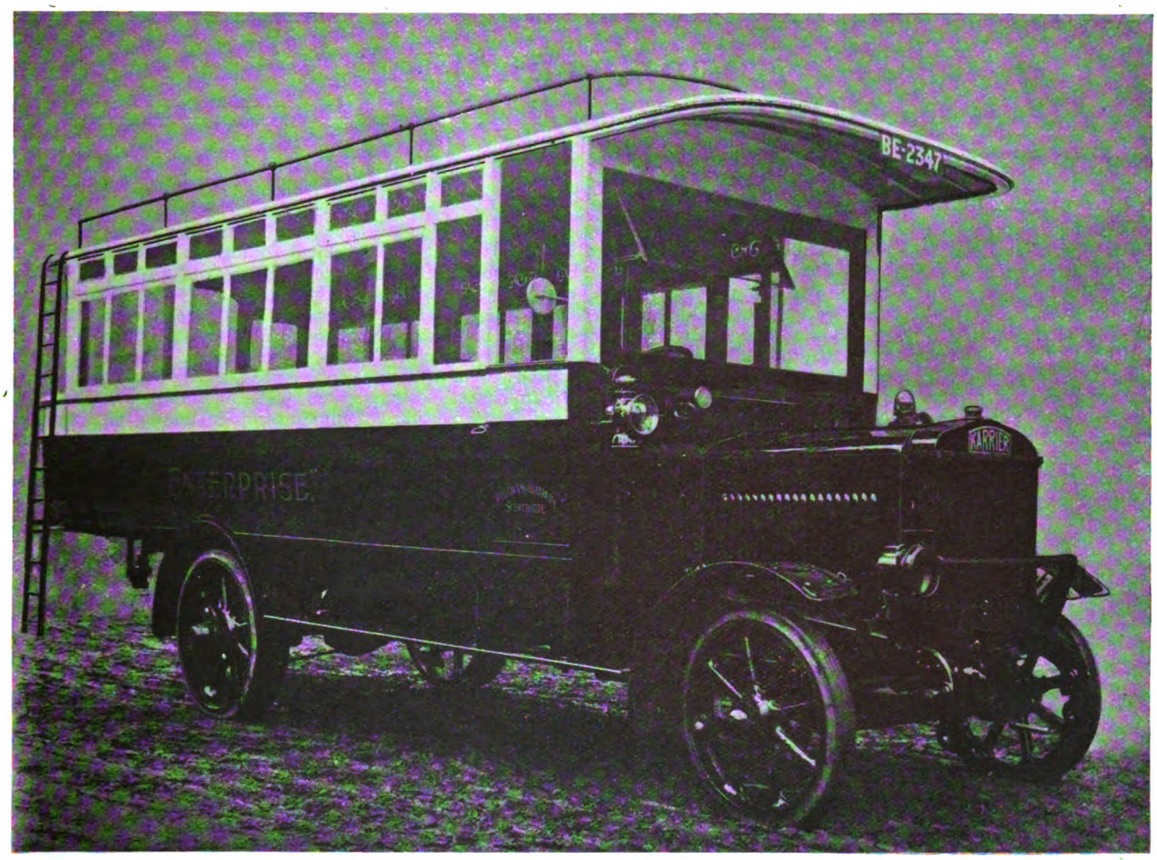
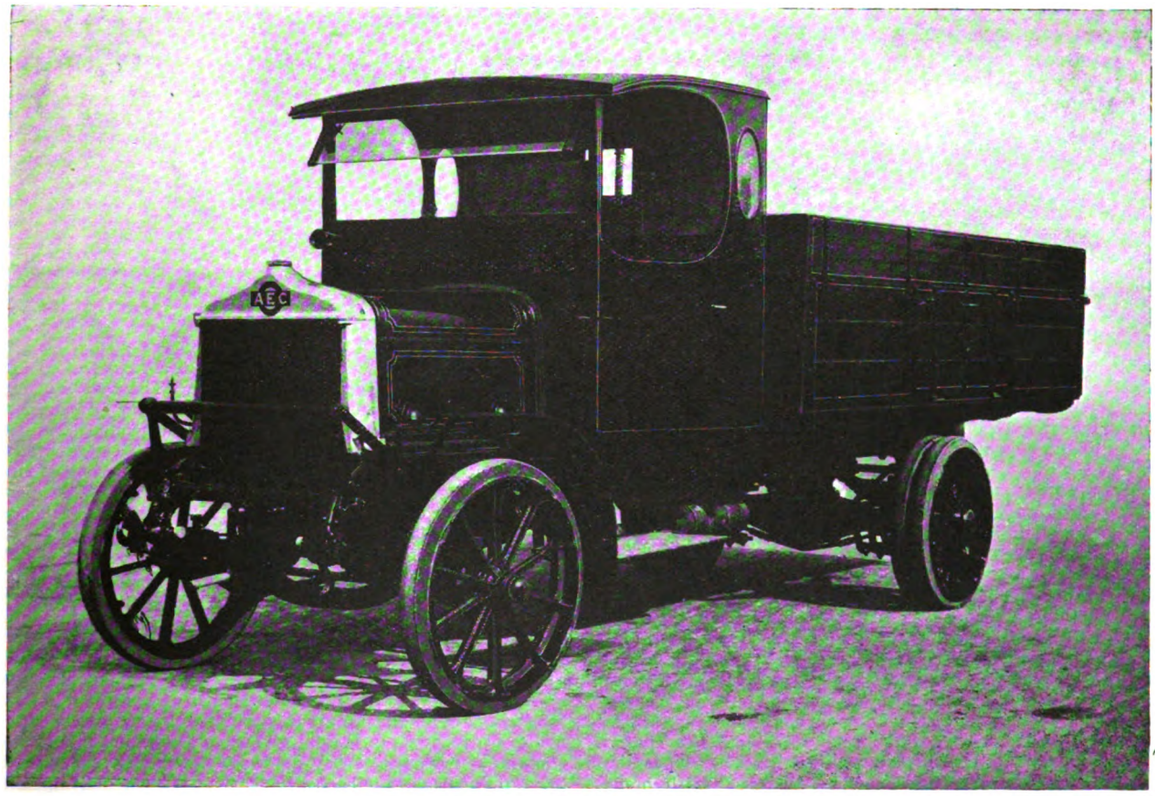


A "Karrier" Omnibus for Rural Service.



A Tipping Motor Wagon Built by the Associated Equipment Company.

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BRITAIN'S COMMERCIAL MOTORS.

A Part to Play in the Solution of Problems.

According to figures presented to a recent assembly of the Commercial Motor Users' Association by Mr. W. Joynson-Hicks, M.P., the latest official returns show that there are 65,000 commercial petrol vehicles and 10,000 steam wagons in this country. Of the total of 75,000, over 35,000 were represented or owned by members of that association, which had 3,000 members and an income of £3,390. Although he was chairman of the Automobile Association, he was prepared to say that in the interests of the country the commercial vehicle came in front of any pleasure vehicle whatever.

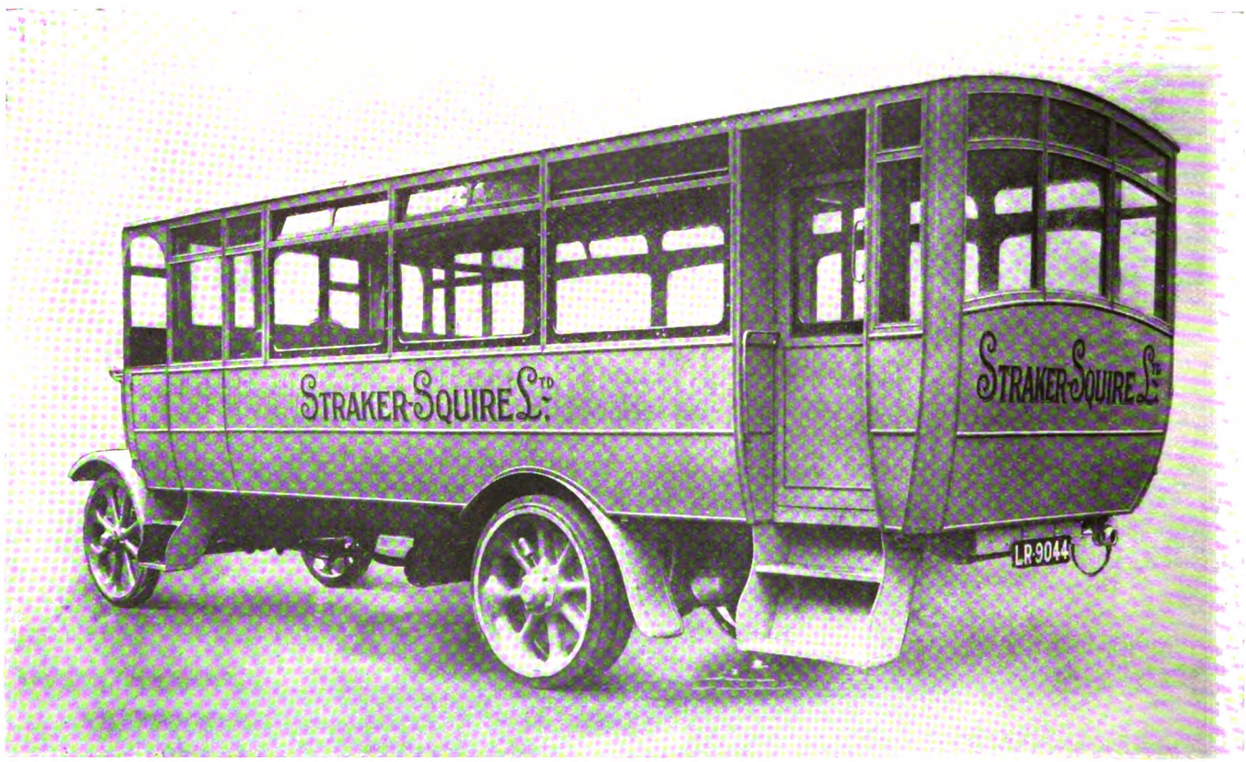
He believed that in the extended use of road vehicles and in the improvement of the roads they would find the solution of many of those great reconstruction difficulties which faced the Government at the present time. The questions of housing, small holdings, and agriculture were bound up with transport, and it was clear that there was no time, even if it were possible, to create either wide gauge or narrow gauge railways out into remote parts of the country. It was the commercial and industrial motor alone that could take the product of the farm to the market without transhipment; the workman from the shop or factory to his home direct; and bring the deserted village into touch with the pleasures and life of the adjoining town.

ROAD TRANSPORT'S REQUIREMENTS.

Mr. E. Shrapnell-Smith, chairman of the Commercial Motor Users' Association, has stated that the association sent a deputation to Sir Eric Geddes, the Minister of Transportation, and Mr. Shortt, the Home Secretary, suggesting in connection with the 48-hour week that something must be done at terminals of railways, docks, etc., to avoid delays. Other points brought forward were:—The motor spirit tax; proper books to be kept by local authorities so that they did not charge to road maintenance figures which ought not to be there, as many authorities charged the cost of cleansing and watering the streets to road maintenance, whereas commercial motor users contended that a large proportion of these charges were rightly matters of health and sanitation. The deputation also put to the Minister certain matters connected with home-produced fuel, questions connected with bridges, and proposals for amendment of the law on extraordinary damage to roads.

STRAKER-SQUIRE NEW MODEL.

The new 55 h.p. patent chassis which Messrs. Straker-Squire are now placing upon the market embodies a number of new features in chassis construction which cannot fail to interest all users of heavy motor vehicles. The machine is of an entirely new design, and will be known as the patent "A.W." type chassis, or "After War" model. It is claimed to be highly economical in working, and can be efficiently employed for net loads of from three to five tons, carrying either goods or passengers. In the latter capacity various types of bodies can be fitted, giving seating accommodation for from 20 to 40 passengers. The outstanding feature of interest to those responsible for public services running to a time schedule is the high engine power. There can be no question of the necessity of ample engine power when it is required to maintain a regular service under all weather and road conditions, even if it should entail a higher fuel consumption. In the present instance, however, it is claimed that owing to the perfection of the design of the engine the consumption of fuel and oil is remarkably low. The four cylinders are cast *en bloc*, having a 4½ in. bore with a stroke of 6½ in. It is governed by patent overhead valve gear. The two-bearing crankshaft is 3 in. in diameter, and is fitted with roller bearings. Lubrication is effected on a novel positive system which has been patented. With regard to fuel consumption, a number of test runs have been carried out under varying conditions, and it has been found that on straightaway runs seven to seven and a quarter miles per gallon can be depended upon when the vehicle is loaded to its full capacity; when empty this may often rise to ten miles.



Side and End View of Straker-Squire New Model.

Another important point which has received special attention is the distribution of weight. The design of the chassis provides for the carriage of a 5-ton net load on a 13 ft. body whose weight does not exceed 16 cwt. This is secured without exceeding the 6-ton axle weight, thus enabling the vehicle to do twelve miles an hour.

Compared with the ordinary subsidy type machine of equal capacity, the total overall length of the new Straker-Squire chassis saves about 2 ft. with the same length of body; it follows that for chars-a-banc and omnibus work the chassis can be fitted with bodies up to 15 ft. in length, giving an additional row of seats and allowing a seating capacity up to 40. Although the normal speed for 5-ton loads is 12 miles per hour, the chassis is built up with three different ratios of worm gear, thus rendering it suitable for travelling at higher speeds for lighter loads and public passenger purposes.

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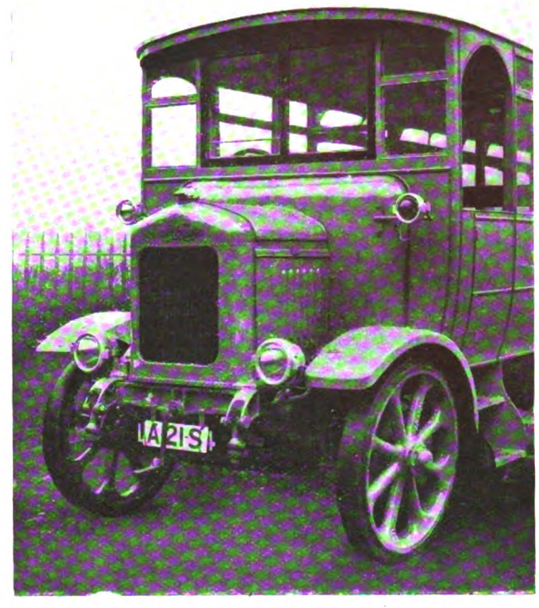
The steering gear is of the screw and nut type, with large wearing surfaces. An exceptional angle of lock of front wheels is provided for, and the gear is as easy to operate as an ordinary pleasure car.

Special care has been taken in the springing of the chassis; the springs are of large size, and all the spring supports are mounted on ball joints with large oil caps. Auxiliary coil springs are also fitted which compensate for unequal load and give easy riding under all conditions.

Hollow spoke steel wheels are employed, those in front taking single tires 140 mm. section, 850 mm. inside diameter, 1033 mm. outside. The rear wheels carry twin tires of the same dimensions. By their large size these wheels assist greatly in reducing the road shocks transmitted to the mechanism, and also the vibration to buildings along the route, a matter of considerable importance in town traffic. Both the pedal brake and the hand brake operate on pressed steel drums bolted to the rear wheels; these are 22 in. in diameter, with a 3-in. face lined with "Ferodo" fabric. The large surface not only ensures an exceptionally powerful braking effect, but gives long life to the linings and drums. The pressed steel frame which has a maximum depth of 7 in. has no rivets in its construction, all the cross members being attached by $\frac{5}{8}$ in. bolts, only two lengths of bolt being used in the entire frame. The engine and gear box is carried on a short stiff underframe by a three point suspension, which gives a perfect and permanent alignment under all conditions.



Front View.

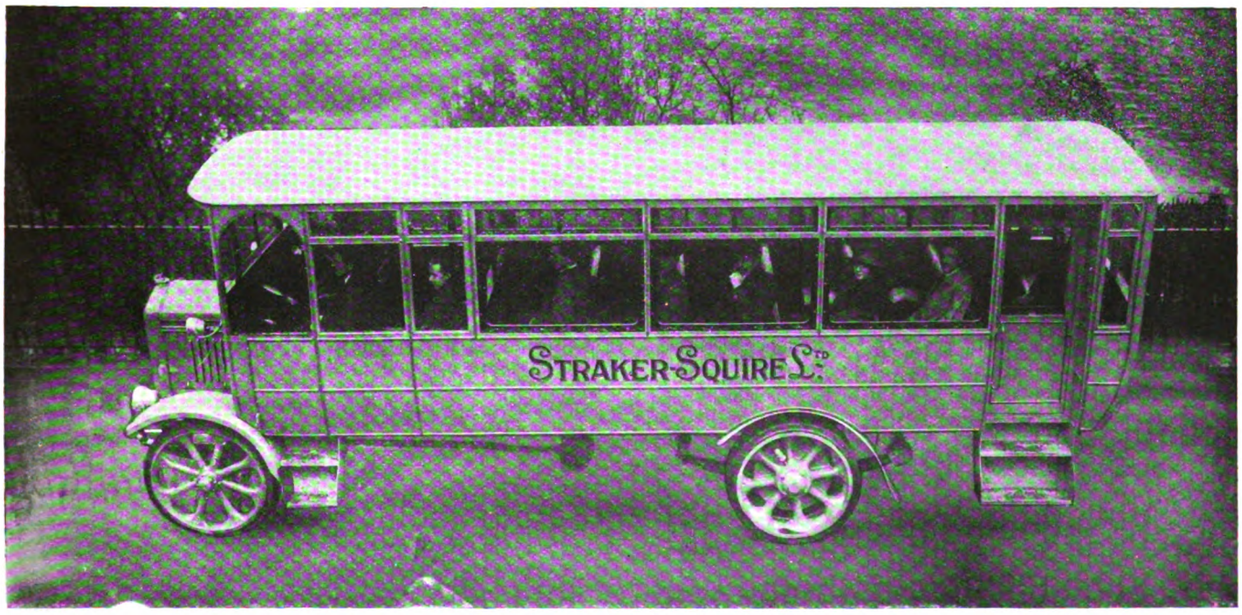
The overall width of the chassis is 7 ft. 1½ in., and the normal length 20 ft. For special purposes, however, it can be increased to a total length of 22 ft. 6 in., the wheel base in each case being 14 ft. 6 in. The single-deck omnibus body shown in our illustrations has been constructed for demonstration purposes. It was built by E. and H. Hora, Limited, of Peckham Road, London, S.E., and can be taken as an excellent example of public carriage work. The body is of the saloon type, with two compartments, the overall length from the dash being 21 ft. 6 in. The front compartment takes up 6 ft. of this space, and is the smoking section.

The main portion of the body is fitted with five garden-type seats to take two passengers on each side, and between these are sliding gangway emergency seats kept under the side seats when not in use, detachable leather straps forming a comfortable back. A long seat is fitted across the rear end to seat three passengers, with a tip-up cricket seat at the near end for one. There is also a tip-up seat at the rear end of the car opposite the entrance door for one person, making a possible seating capacity in the rear portion of 30.

The smoking compartment contains a long seat for five persons, next to the partition, and another for two beside the driver. The driver's seat is left short, so that access can be obtained to the compartment, but a tip-up seat for one is provided at the end making a total of eight, exclusive of the driver. The interior has been tastefully finished off with lining panels of 3-ply finished in the natural wood. There are three main body windows in the rear portion in polished mahogany frames, with folding ventilators to match. The main body windows are held in detachable brass fittings, and can be removed at will. All the seats are provided with spring cushions and stuffed and raised backs in imitation leather.

The usual coach type of door shown in the illustrations can be dispensed with, and a folding lattice-work steel door fitted in its place with a waterproof curtain inside to keep out dust and wind. Spring roller waterproof blinds are fitted over the high side doors to the front compartment, and also to the windows at the back of the driver to prevent reflections at night. The front compartment is entirely separated from the rear portion of the body by a partition panelled up to the window level, and continued to the roof by fixed plate-glass windows.

A Vandervell lighting set provides ample illumination of the interior; there are six lights in the rear portion of the body and



Side View showing Seating Arrangement.

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MOTOR TRAFFIC

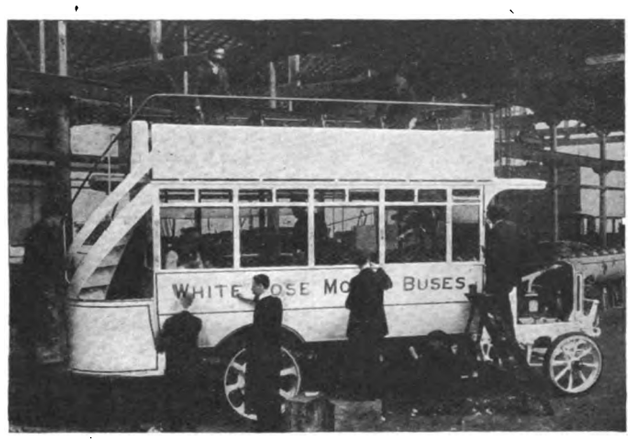
one in the smoking compartment, each of these being fitted with ornamental glass globes fixed to the roof. Head lights, side lights, and rear lights are also provided.

The exterior of the body is finished off in motor grey with darker grey mouldings and fine red lines, and presents a handsome appearance.

Messrs. Straker-Squire have already received orders for a considerable number of these machines, and with the completion of the organisation of their new works will be in a position to meet all demands; at the moment, however, orders can only be dealt with in strict rotation.

A LEYLAND OMNIBUS IN THE SHOPS.

One of the latest types of double deck omnibuses which are now going through the shops of Leyland Motors, Limited, is shown in the accompanying view. When the photograph was taken, the painters and upholsterers were just finishing off the vehicle at high



speed, in order to complete it for the Easter traffic. This particular machine is one of a small fleet for Rhyl and is mounted on a standard Leyland "G" type chassis, which carries a 34-40 H.P. engine.

CO-ORDINATION OF LONDON SERVICES.

In the House of Commons Mr. Leonard Lyle asked the right hon. Member for Cambridge whether he proposed to take in hand as one of the earliest aspects of policy the whole question of transportation in London; and whether his department will possess sufficient powers to regulate, co-ordinate, and extend the existing means of locomotion in London, apart from the tramways under the control of the London County Council?

Mr. Shortt, who replied, said: "My right hon. friend is fully alive to the importance of the question of London transport, and if and when his Ministry has been established he will go into the matter. Under the powers sought to be obtained by the Bill to establish the Ministry of Ways and Communications it should be possible to regulate and co-ordinate existing services to a considerable extent, and if these powers prove insufficient it will be for the Minister to consider whether Parliament should be asked to give further powers."

MOTOR SPIRIT LICENCES.

The Board of Trade announces that on and after May 17, 1919, motor spirit may be purchased without the production of a motor spirit licence. Any holder of a full-duty or half-duty motor spirit licence who has not been supplied with the total amount of motor spirit authorised to be supplied by his licence may apply to the Petrol Control Department for an appropriate repayment of duty, and such application must be accompanied by the licence in respect of which repayment is claimed. Repayment will not be made in respect of loose vouchers. Applications for repayment should be made as soon as possible after May 16, 1919, and addressed to the Petrol Control Department, 19, Berkeley Street, London, W.1.

INTERNATIONAL MOTOR CONGRESS.

DEMAND FOR REDUCTION OF TAXES AND DUTIES.

The Motor Legislation Committee announce that the automobile industries of Belgium, France, Great Britain, Italy, and the United States were represented at a recent meeting of the International Motor Congress held in Paris. The following resolution was adopted unanimously:—

"In view of the production during the present war by the automobile industries of the allied countries of war materials of all kinds, and of the services rendered by automobile transport of the highest importance to the armies; and in view of the fact that motor transport of passengers and goods is now an indispensable condition in modern life; that motor transport generally has long ceased to be a matter of luxury, and has become a necessity for commerce and industry; we recommend that the internal taxes and duties of all kinds direct and indirect which fall heavily on automobilists in most of the allied countries, be largely diminished in order to promote normal and progressive development of automobile communication, and that the product of these taxes and duties be applied to the upkeep and improvement of the roads."

A statement issued by the Motor Legislation Committee calls for the immediate abolition of the special duty of 6d. per gallon imposed on petrol by the Finance Act, 1916, and for the earmarking for the purpose of road improvement of the proceeds of the taxation of motor vehicles and motor spirit levied under the Finance Acts, 1910 and 1915. In the latter year the duty on motor spirit was doubled, and the revenue derived from the foregoing taxation was diverted to State purposes. The Committee point out that the development of road transport is entirely dependent upon the import of fuel, and they urge that the question of the encouragement of home-produced fuel is of vital importance to commercial and industrial prosperity.

LONDON TRAFFIC IMPROVEMENT.

Mr. Frank Pick, commercial manager of the Underground Railways Company, has stated that 62 cars for the Tube Railways are on order, and that tenders have been invited for 100 District Railway coaches as a first instalment. A new type of omnibus has been designed and the building of the new vehicles will begin in about two months. At present 250 omnibuses of the type now in use are being manufactured. Extensions of the Hampstead Tube to Hendon, the enlargement of the City and South London Tube from narrow to standard gauge, and the coupling up of that line and the Hampstead and Highgate line are proposed. To carry out existing unfinished schemes will require an estimated expenditure of £3,000,000. "The crux of the whole question of traffic difficulties in London," said Mr. Peck, "is rolling stock. The hardest thing to buy to-day is a passenger car."

OVERCROWDING OF OMNIBUSES AND TRAMCARS.

In reply to a question by Mr. Higham, the Home Secretary said that he was well aware of the overcrowdiug of omnibuses and tramway cars in London. It had been necessary to allow a limited number of excess passengers to meet the shortage existing by the withdrawal of omnibuses for military use, and by the impossibility of replacing worn out vehicles during the war. The police have temporarily reduced their requirements with regard to the vehicles to the lowest possible point consistent with safety, in order to allow as many vehicles as possible to continue to run. Neither he nor the Commissioner of Police was responsible for the supply of vehicles, but the Commissioner had reason to believe that the operating concerns were doing their utmost to cope with the situation.

CIVILIAN FLYING.

The ban on civilian flying was raised on May 1, and the Air Ministry have published some details of the aerial routes which it is thought desirable to use at first. These are described as the trunk aerial routes, and have been chosen with reference to the situation of existing aerodromes and military demands. An attempt has been made to establish direct communication between London and Ireland, and London and the North, and also to cater for some of the more important centres which lie along the routes. The suggested routes are as follow:—London-Scotland, London-Dublin, London-Manchester-Belfast, a Continental route, a Dutch route, London-Plymouth, and London-Bristol.

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MOTOR TRAFFIC

MOTOR TRAFFIC NOTES.

INCREASED COST OF AMBULANCE RUNNING.—Owing to increased wages, etc., the Metropolitan Asylums Board are charging Poor Law Guardians 1s. a mile instead of 9d. for the hire of motor ambulances.

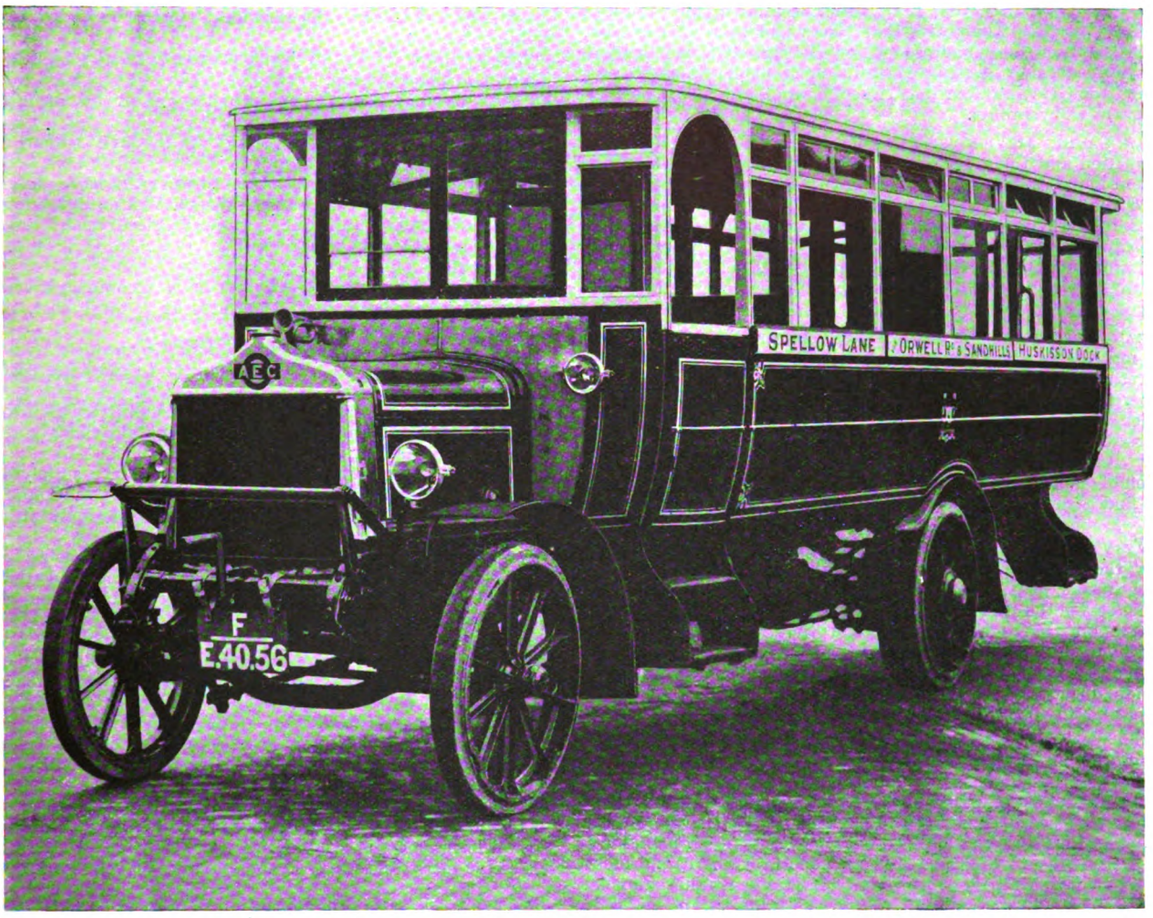
IMPORTATION OF EDISON CELLS.—The President of the Board of Trade on April 23 issued an order removing the restriction on the importation of Edison cells (and component parts) for electrically-propelled vehicles.

THE SOLID TIRE COMMITTEE.—Mr. H. Shankland, of the Shrewsbury and Challiner Tire Company, has been appointed chairman of the Solid Tire Committee of the Society of Motor Manufacturers and Traders for the ensuing year.

restricted and freed imports. The restrictions include the following:—Motor vehicles and accessories restricted to 50 per cent. of 1913 imports until September 1, 1919.

OMNIBUSES AND STREET LAMPS.—Camberwell Borough Council have had correspondence with the Commissioner of Police as to street lamps said to project from the footways and interfere with traffic. The Council contend that any difficulties are caused through the manner in which the vehicles are constructed, and suggest that vehicles with top decks overhanging the wheels should not be licensed.

EASTER OMNIBUS TRAFFIC.—Notwithstanding the increased fares and the greatly augmented number of omnibuses running on the routes, there was more traffic than could be carried during the Easter holidays on the country trips within a thirty miles radius of Charing Cross. Over the London-Croydon tramway route there was a



Single Deck Omnibus Seating 32 Passengers—One of a Fleet ordered by the Liverpool Corporation from the Associated Equipment Company.

EXETER-TORQUAY OMNIBUS SERVICE.—Pending the receipt of more precise information, Exeter Tramways Committee have deferred making recommendations in regard to the running by a company of a motor omnibus service between Exeter and Torquay.

SUNDAY OMNIBUSES FOR TEESIDE WORKMEN.—The difficulties with the Teeside workmen arising from the suspension of the Sunday tramway services were removed by the consent of the Imperial Tramways Company to run a service of motor omnibuses on Sunday solely for workmen.

LEICESTER NEEDS MORE OMNIBUSES.—Before the war Leicester Tramways Committee had arranged to run a motor omnibus service to Syston, by the Thurmaston route, when the Government impressed the omnibuses. The Corporation are now seeking to obtain omnibuses wherewith to start the service.

THE RESTRICTION OF MOTOR VEHICLE IMPORTS.—The new Consultative Council on Imports on April 11 issued, under the authority of Sir Albert Stanley, President of the Board of Trade, a new list of

constant procession of omnibuses running to and from Redhill, Reigate, etc.

LEYLAND OLD CHASSIS REALISES OVER £500.—As evidence of the high prices that are at present commanded by industrial motor vehicle chassis of the best makes, it is interesting to note that at a recent sale conducted on behalf of the Government Stores Disposal Board at the Agricultural Hall, a Leyland omnibus chassis dated 1914 which was not in the best of condition, realised five hundred and eighty guineas.

U.S.A. TRUCK EXPORTS.—A Washington report states that during January, 907 trucks valued at $2,375,584 were exported. This shows an increase of 11 trucks and a decrease in valuation of $261,105 over December, 1918, during which month 896 trucks valued at $2,636,689 were exported. The figures for January, 1919, show a decrease of 249 trucks over January, 1918, at which time 1,156 trucks valued at $3,328,870 were exported. The difference in valuation is $953,286.

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MOTOR TRAFFIC

NEW OMNIBUS SERVICE AT HUDDERSFIELD.—The motor omnibus service recently instituted between Waterloo tramway terminus and Kirkburton has proved a great convenience, not only to the residents in the district, but also to visitors to Storthes Hall Asylum. The service is hourly, and the two omnibuses employed on the route have been fully engaged, especially on Sundays, when there is no train service to Kirkburton.

NO DANGER OF FAILURE OF PETROL SUPPLIES.—No matter how large the demand may be, Sir Marcus Samuel considers that there is not the slightest danger of failure of the petrol supplies. At the present time the storages of the country are full to overflowing, so that it is almost impossible to land a cargo. If the entire supply from the United States were to fail, Sir Marcus says that there is enough petrol in the rest of the world to meet all requirements.

GOVERNMENT BLAMED FOR PETROL PRICES.—Sir Marcus Samuel, the chairman of the petrol combine, has informed the Commercial Motor Users' Association that it was not the fault of the producer or of those who dealt in petrol that prices had been at the level at which they had been maintained for so long. The matter had been entirely outside of their control. Such blame as there was must rest upon Government departments, who seemed to consider it a duty to show profits.

A TIME-SAVING DEVICE.—At the new terminal of the Northern Ohio Traction and Light Company at Akron a feature of the office equipment is the dictagraph interconversing system for talking from office to office direct without connecting through an operator's switchboard. These machines are very sensitive, and conversation can be carried on without talking directly into the transmitter. This eliminates much of the calling through the telephone switchboard, thus saving time in direct office calls and preventing congestion of calls on the city lines.

GERMAN EXPERIENCE OF GAS-DRIVEN MOTORS.—At last year's annual meeting of the German Association of Gas Engineers, the belief was expressed that there would be an increasing demand for gas for road motors. The opinion was expressed that the roof gasholder offers more advantages than any yet proposed system of compressed gas in cylinders. One advantage is the avoidance of weight. Experience in Berlin with 3-ton vehicles shows a consumption of one cubic metre of gas per mile. In London it is difficult now to find a gas-driven car or wagon, despite of the high price of petrol.

HEAVY VEHICLES AND SIDE GUARDS.—Asked whether he would consider the question of compelling heavy motor vehicles to be fitted with side guards, the President of the Local Government Board has stated that the matter was considered by the Departmental Committee on Heavy Motor Cars, and they recommended that further investigations should be made with a view to overcoming the difficulties. As the powers of the Local Government Board in relation to motor vehicles are being transferred to the Ministry of Ways and Communications, further action will be left to the Ministry.

GAS-DRIVEN TRAMWAY CARS.—A New York correspondent of the *Daily Express* reports that Mr. C. E. Scrensen, general manager of the Ford Tractor Company, announces that plans are being completed for the use of gas-propelled tramway cars. One of the designers of the Liberty engine used in American war aeroplanes has gone to Detroit to assist in the demonstration of the new cars, which, it is stated, will begin work over the Detroit Tramways this summer. Mr. Screnson is evidently an optimist on gas traction, and declares that electric tramcars now seen on city streets will soon become things of the past.

ROAD CONSTRUCTION PROGRAMMES.—While to a certain extent the improvement of roads in Great Britain is being held up by controversy as to the roads coming under the authority of the Ministry of Ways and Communications, Canada and the United States are engaging in great schemes of road construction in order to facilitate motor traffic. The Dominion Government recently announced their policy for the building of national highways. What is being done in one State of America may be taken as typical of the road plans adopted in other States. It is planned during the present year to build 3,500 miles of primary roads in Pa., the State paying for the same. The new roads will have concrete foundations.

MINISTERS' MOTOR CARS.—The Chancellor of the Exchequer has stated that before the war it was not the custom to supply ministers with motor cars at the public expense. During the war the position had changed and cars had been supplied to ministers holding the more important offices under the Crown. For the War Office, 43 cars were employed, and their use was restricted to work in connection with public service. The whole question of the use of such cars by ministers or other officials was being considered by the Government with a view to its restriction as far as might be, and to the establishment of a stricter control than had been practicable under the exceptional conditions prevailing during the war.

MOTOR VEHICLES FOR MUNICIPALITIES.

DARLINGTON RURAL COUNCIL have purchased a 5-ton petrol chassis.

LONDON COUNTY COUNCIL TRAMWAYS are obtaining six 4-ton petrol lorries.

WHITEHAVEN COUNCIL are expending £1,157 on purchasing a motor fire engine.

HORNSEY CORPORATION have voted £11,500 for the purchase of six motor vehicles.

MELTON MOWBRAY RURAL COUNCIL contemplate purchasing two steam tractors

CORK RURAL COUNCIL have bought a motor lorry for haulage of building materials.

WEST RIDING STANDING JOINT COMMITTEE have decided to buy a motor lorry at £1,100.

ESSEX COUNTY COUNCIL are providing a car for the use of the Harold Court Sanatorium.

KEITH DISTRICT COMMITTEE and BRIXWORTH RURAL COUNCIL have purchased steam tractors.

MANCHESTER CORPORATION GAS COMMITTEE have ordered two tipping wagons from the Sentinel Wagon Works, Shrewsbury.

LONDON COUNTY COUNCIL Tramways department are adding six 4-ton petrol lorries of not less than 40 H.P. to their stock of road motor vehicles.

READING TRAMWAYS COMMITTEE have recommended the Corporation to purchase five omnibuses at a total cost, including equipment, of £7,750.

POPLAR COUNCIL have purchased four Government 5-ton steam tipping wagons at £570 each, and expect to save the cost during the first year's working.

GLASGOW CORPORATION have sent a committee to inspect the haulage plant and appliances provided for cleansing purposes at London, Birmingham, and Sheffield.

EDISON ACCUMULATOR COMPANY, LIMITED, are supplying three electric vehicles at £1,304 each to Taunton Town Council. One vehicle will be provided with an interchangeable body at an extra cost of £300.

GLOUCESTERSHIRE COUNTY COUNCIL are purchasing 30 War Office lorries, the county surveyor having reported that great economies would result from motor haulage in connection with road reconstruction.

BIRMINGHAM BUYING ELECTRICS.—The Birmingham Corporation have purchased three electric vehicles for the collection of house refuse at a cost of £1,304 each, and intend yearly to displace horses by the purchase of further vehicles.

OMNIBUSES FOR EDINBURGH.—The Tramways Committee have accepted tenders for 12 motor omnibuses at a cost of £1,431 each, and three chars-a-bancs at £1,341 each from Messrs. Leyland Motors, Limited, Leyland, Lancashire.

PRESTON CORPORATION have appointed a committee to report on the advisability of adopting motor traction, the cleansing superintendent having visited various towns in order to ascertain the respective merits of petrol, steam, and electric vehicles for cleansing work.

LUTON COUNCIL have been advised by the Electricity Committee to obtain an electric 3½-ton wagon from Edison Accumulators, Limited, at £1,607. It is estimated that £400 yearly could be saved by using the vehicle for the removal of clinker from the generating station.

HOME OFFICE AND MOTOR OMNIBUSES.

In the House of Commons, on April 8, Mr. Gilbert asked the Home Secretary what powers his department had over motor omnibuses in London and district, and if they had any control over routes or fares? In reply, Mr. Shortt said that by the Metropolitan Public Carriage Act, 1869, the Secretary of State for the Home Department is given power to grant licences for stage carriages, their drivers and conductors. This power by successive Orders he had delegated to the Commissioner of Police, who caused each vehicle to be inspected and, if found fit, licensed for public use. Interference with the routes of public omnibuses is entirely forbidden by the Metropolitan Streets Act, 1869, but before licensing a stage carriage its fitness for the particular route is considered by the Commissioner. The amount of fares chargeable is in the discretion of the proprietor of an omnibus.

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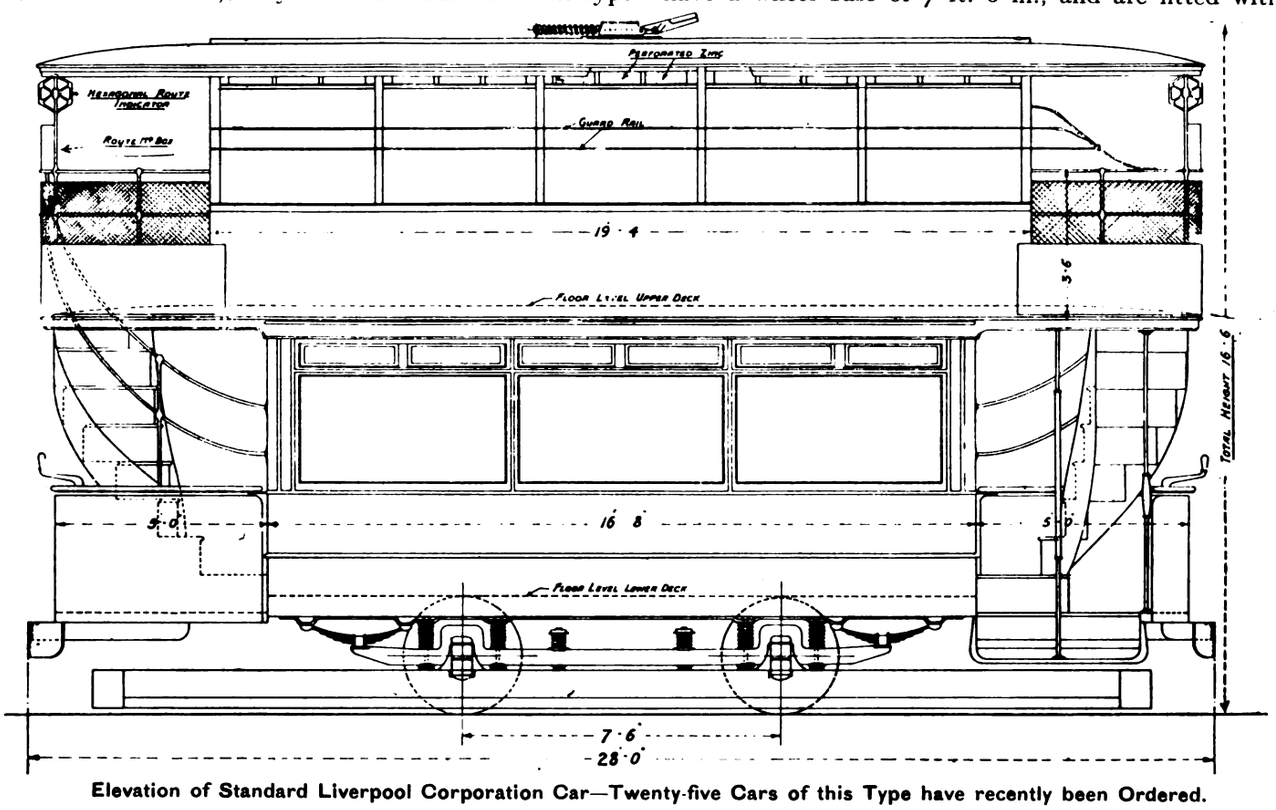
THE Tramway & Railway World
WITH MOTOR TRAFFIC SECTION

Founded 1892. LONDON, JUNE 19, 1919. Vol. XLV.

NEW CARS FOR LIVERPOOL CORPORATION TRAMWAYS.

Among the first Corporations to place orders for new tramway cars after the armistice was Liverpool. The congestion of traffic in that city had rendered necessary a considerable addition to the rolling stock, and the Tramways and Electric Power and Lighting Committee, with notable enterprise, lost no time in deciding upon the type of car and in placing orders. On the recommendation of their general manager (Mr. C. W. Mallins), they decided to adhere to the type of car which was standardised at Liverpool many years ago. The single-truck car, with reversed stairway and canopy top, has been found to be well adapted to the requirements at Liverpool, and although the Corporation has made use of a number of other types, which have been well tested in operation, the general manager had no hesitation in adhering to the standard type.



Elevation of Standard Liverpool Corporation Car—Twenty-five Cars of this Type have recently been Ordered.

Tenders were received on February 3, and in due course an order for 25 completely equipped electric cars was placed with The English Electric Company, and the first of these cars are about to be delivered. As will be seen from the accompanying drawings, the cars are of the single-truck, double-deck, reversed staircase type. The new cars will provide seats for 64 passengers, 22 on the lower and 42 on the upper deck. The seats on the lower deck are longitudinal, while on the upper deck there are cross seats with reversible backs, arranged as shown on the plan. The cars are mounted on trucks of the Brill type, with forged side frames 12 in. deep on the axle box, 4¼ in. in the centre, and 4 in. outside of the axle box. They have a wheel base of 7 ft. 6 in., and are fitted with wide wing Brill type cast-steel boxes. The axles are Siemens-Martin forged steel, capable of bearing a tensile strain from 32 to 37 tons per square inch. The wheels are 33½ inches outside diameter, and are fitted with 27½ in. steel centres and 3 in. steel tires of British standard specification.

The electrical equipment consists of two 40 H.P. Dick, Kerr motors and controllers. The latter are of the solenoid blow-out series-parallel type. Each car is wired for five circuits of five lights each, fitted with standard metallic filament lamps. An electric bell and push are placed at each end of the car, with six pushes inside the car, three being placed on each side.

In the underframe of the car body the sole bars are

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of English oak, and all members run the full length of the body. The platforms project from the main framing, and the two outside bearers are plated their whole length with quarter-inch steel plates well secured. The platforms are 5 ft. in length, and are floored with pine boards, as are the floors of the car. Trap-doors are arranged as usual in the floor to give access to the motors. The whole of the pillars and rails of the body framing are of English oak, and the corner pillars are strengthened with wrought-iron angle pieces. All external panels and mouldings are of bay wood. Roof ribs are of English ash, strengthened by $\frac{3}{8}$ in. steel car lines in every roof stick. The interior of the car is finished with quartered English oak in the natural grain of the wood. The side windows of the lower deck are fixed, and consist of 5-16 in. polished plate-glass, bedded with grooved rubber strip and secured by wood beading. The seats on the lower deck are divided into three lengths, and are fitted with rattan seats and backs.

The trolley bases are of the Brecknell, Munro and Rogers type, with ball bearings, and the trolley head is of the new anti-fouling type designed by Mr. C. W. Mallins.

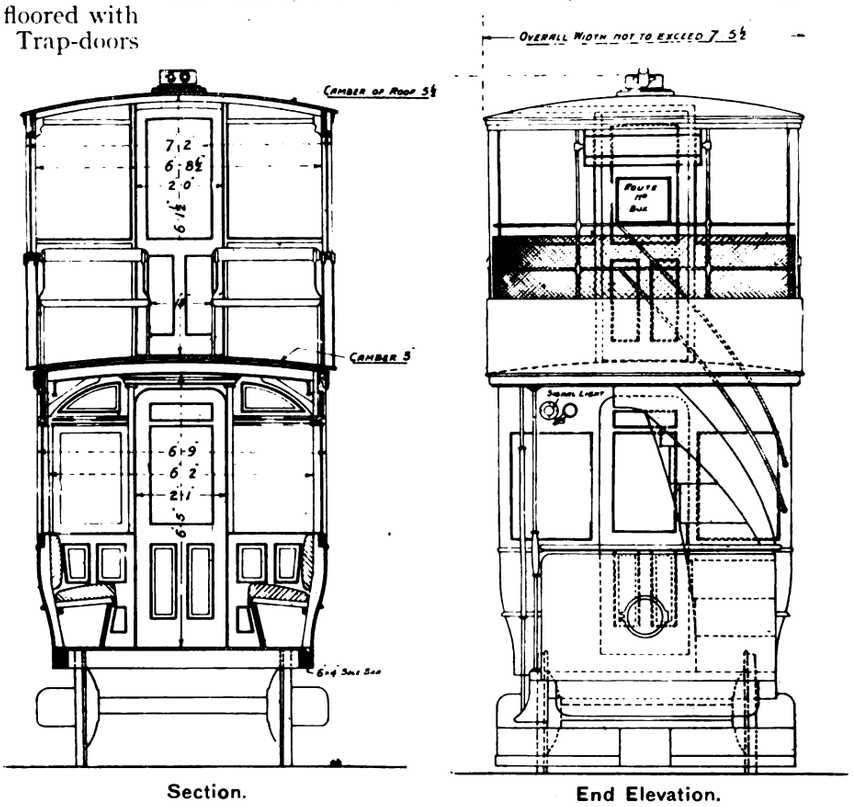
The following table gives the leading dimensions of the car :—

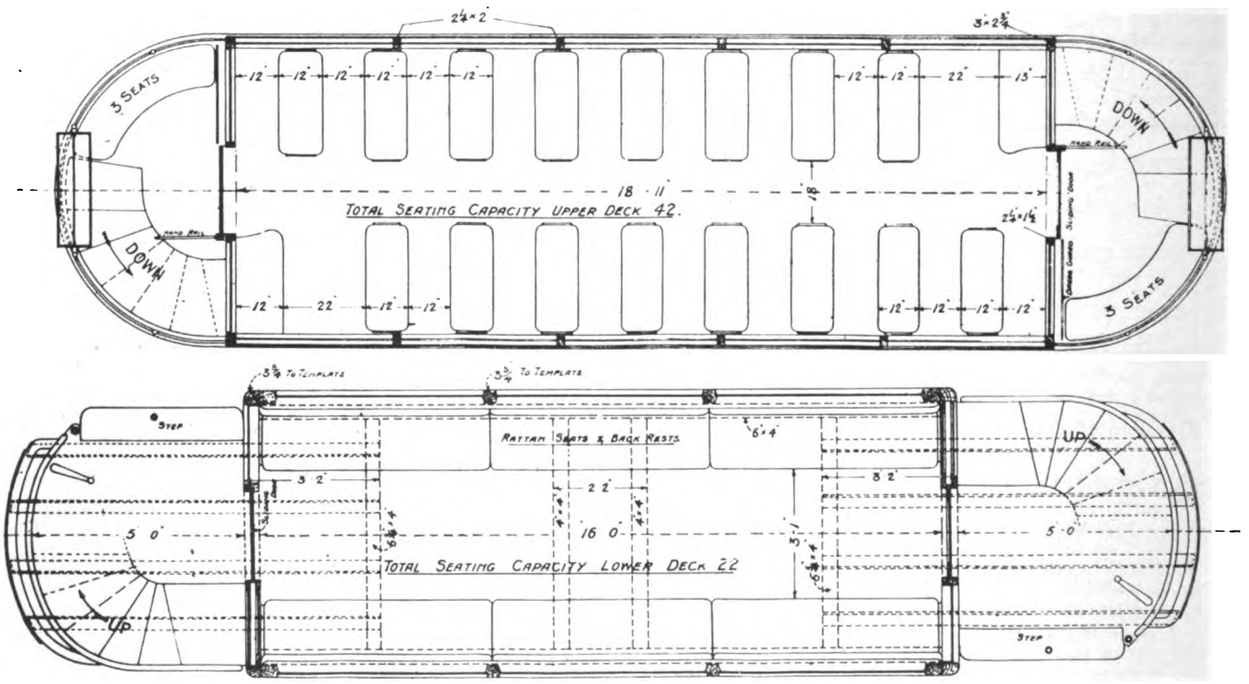
Length over buffers	28 ft. 0 in.
Length of each platform... ...	5 ft. 0 in.
Length of body (inside lower deck)	16 ft. 0 in.
Length of body (inside upper deck)	18 ft. 11 in.
Width over all	7 ft. 5½ in.
Wheel base	7 ft. 6 in.
Clear height inside at centre of lower deck ...	6 ft. 5 in.
Clear height of upper saloon at centre ...	6 ft. 1½ in.
Height over trolley base	16 ft. 6 in.

No drawbar is fitted to these cars, but a chain is kept on each car for towing, if disabled.

Lifeguards of the Liverpool type, entirely enclosing the wheels, are fitted to the truck, and there are four pedal sand boxes, also of the standard Liverpool type.

Destination indicators are fitted at each end of the car, as shown on the drawings. Route number boxes are placed at each end of the car.





Plan of Upper and Lower Decks—Liverpool Corporation Standard Car.

Height of end door openings, lower saloon ...	6 ft. 0 in.
Height of end door opening, top saloon	5 ft. 9 in.
Height from rail to under side of trolley base ..	16 ft. 0 in.
Height of floor above rail	2 ft. 8 in.
Weight when equipped, but empty, about	10 tons 12 cwt.

For the foregoing particulars and the accompanying drawings we are indebted to the courtesy of Mr. C. W. Mallins, general manager of the Liverpool Corporation Tramways.

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TOWN-PLANNING AND TRAMWAYS.

A Scheme Providing a Notable Improvement in Transport Facilities.

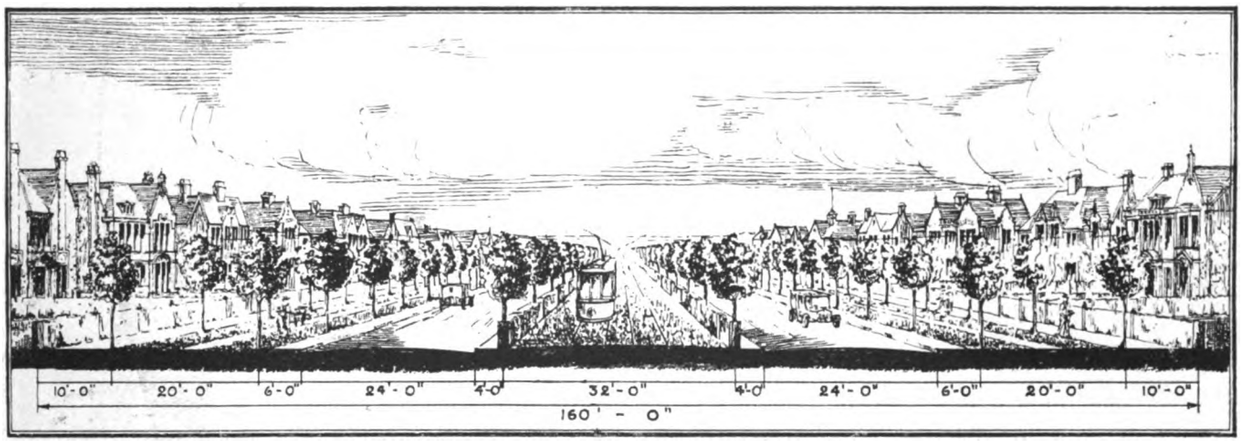
Mr. James Thomson, city engineer of Dundee, recently presented to the Housing and Town Planning Committee of the Town Council comprehensive improvement schemes to be carried out over a long period of years. The schemes are embodied in an interesting report which included ten large scale maps showing clearly the work done, together with an aircraft view of Dundee and neighbourhood, showing areas to be reclaimed and the route through the district of the proposed national East Coast highway. Mr. Thomson urges the Council to keep the subjoined proposals fully and clearly in view :—

(*a*) That if the expansion of the city and district is to go forward advantageously, economically, and scientifically, and if the interests of future citizens are to be fully conserved, the preparation of a plan of development is necessary ;

(*b*) That such a plan to be sufficiently comprehensive must include schemes designed for execution many years hence and beyond present day requirements ; and

(*c*) That the plan is overdue, and its preparation has become urgent.

Under former conditions, traffic streets were made unduly narrow and residential streets unnecessarily wide, and gradients were fixed excessively steep and without regard to the contours of the land. Under the conditions now proposed, this could not possibly recur. Assuming consistent adherence to a comprehensive plan, great advantages would be obtained. Streets would be designed ahead of actual requirements, while the widenings of main traffic roads could be carried out as opportunities permitted and as parts of a feasible scheme of new main traffic roads. Such a plan would ensure the necessities of traffic being provided for in a systematic design of roads, tramways, and railways and their connections, so that expedition and economy in transport would result.



Park Ways as Proposed at Dundee—Tramways on Special Track Free from Obstruction.

Parkways and Tramways.

Mr. Thomson's scheme is divided into the following sections :—

(1) Removal of congestion ; (2) central main streets ; (3) existing and proposed main arterial roads and the land beyond the city boundaries ; (4) outer ring road and the parkways ; (5) river front and the roadway over the Tay ; (6) parks and open spaces ; (7) transit ; (8) present and future housing and industrial areas ; (9) comprehensive plan of development ; and (10) proposals which should be considered (*a*) now, and (*b*) later.

Ideal conditions in expansion are impossible of attainment, but in the preparation of a plan of development the aim should be to achieve as nearly ideal conditions as existing obstacles will permit. It is proposed that a ring road should be formed mainly through undeveloped land, and that certain existing roads should be made parkways for the purpose of forming a connected system of public parks. While these would be beautified with trees and grass borders, their utility as public thoroughfares would not be disturbed. It is suggested that all land required for the ring road or for the parkways should be given free of charge by the owners, because the land through which these thoroughfares pass is certain to be greatly enhanced in value for building purposes. In addition, the owners of property would repay to the Council a large proportion of the cost of forming these roads opposite their properties, in view of the exceptional attractiveness of their frontages ; the tramways account would bear the cost of the construction of the tramway track, and in these ways the expense to the ratepayers would be reduced.

The ring road would connect at both ends with the river front, and extend along the east, north, and west undeveloped parts within and beyond the city, forming junctions with important roads. The length of this ring road would be seven miles, and its width 160 ft., comprising a central tramway track laid in the grass, two carriageways, one each side of the tramway, and two ample footways, and having also six rows of trees, two along the tramway and two on each of the footways. Only a portion of the length and width of the road would at the outset be opened up. When completed, with its provision of two carriageways for traffic travelling in opposite directions, its separate track for swift tramway service, its easy gradients, and its junction with main arterial roads, it should become one of the most useful and attractive of traffic and pleasure thoroughfares, opening up building land with exceptional frontages for residences.

The parkways as far as possible follow the lines of existing roads, and form links with the parks, so as to continue to serve as traffic roads. Like the ring road, they would be tree-planted and provided with grass verges.

If full advantage is to be taken of the undeveloped land on the outskirts, and the urban and rural areas blended in a comprehensive plan of development, it is of the first importance that cheap and rapid transit facilities should be provided. Without these facilities in the form of either tramways or motor omnibuses, and without collaboration between the housing and tramway departments, successful schemes of expansion will be impossible.

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NEED FOR FURTHER TRANSIT FACILITIES.

The Dundee tramway system is in the form roughly of seven lines radiating from High Street to seven termini near the outskirts. It may be diagrammatically represented as a fan with seven radial lines to the outlying districts showing how these districts may be conveniently connected up by tramways on the proposed outer ring road.

Each of the seven radial lines commences in and passes through an industrial area, and each passes into and terminates in a residential area. Stated generally, these lines terminate at or near undeveloped land; and it is at this point the necessity presents itself for the inclusion in the comprehensive plan of city development of a well-considered scheme making provision for transit facilities for all the outskirts, which can be put into execution in parts as the necessities of districts demand. Such a scheme, designed, as it should be, in conjunction with and as part of the plan of development, would have great influence on the economic expansion of the city.

The question of whether transit facilities should take the form of tramways or motor omnibuses is one which need not be settled now, but whatever form these may take the development plan should provide ample width on arterial roads and on the outer ring road for the construction of tramways on a separate and special track in grass without concrete foundation or paved surface, the rails being laid on sleepers in ballast.

The advantages of such a method of construction are many. The roads would be beautified and would partake in the outskirts of the nature of avenues; the cost of track construction would be largely reduced; the expense of upkeep would be considerably less; there would be much saving in wear and tear of rolling stock; the cars would run more smoothly; there would be less noise and dust, and there would be no obstruction by ordinary traffic.

Rapid transit is impossible on the city tramways under existing conditions, but given the method of construction and conditions above described, a speed of thirty miles an hour could be attained with stopping places on extended tramways in and beyond the outskirts. On this point the following quotation from the report of the Royal Commission on Housing in Scotland is apt, and applicable to more places than Dundee:—

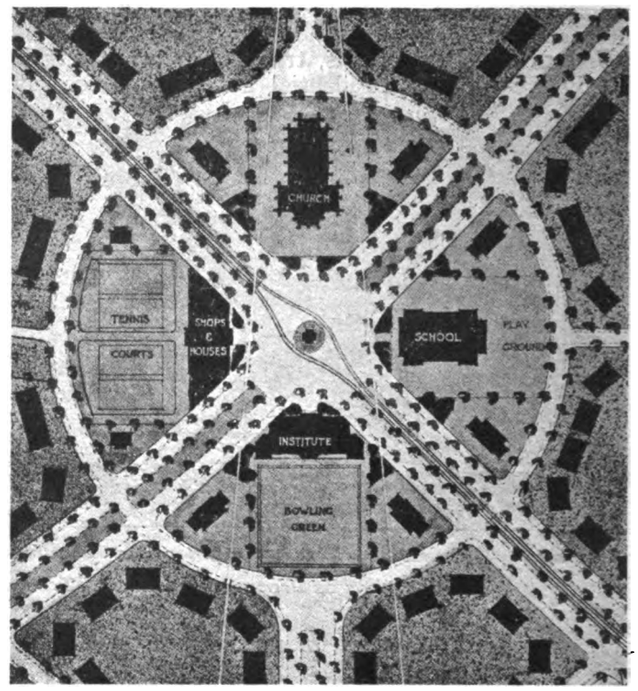
"We are much impressed with the necessity for the construction of main roads out of cities and populous places in such a manner that new cheap land may be opened up for building purposes. This principle of opening up new land and spreading the population involves the necessity of providing cheap and rapid transit. At the present time the average speed of tramways in the centre of a city is extremely slow. The speed increases more or less proportionally to the distance from the centre; but even in the suburbs a speed of twelve miles is usually the prescribed maximum. Such restrictions are, no doubt, quite right in the interests of public safety in the present order of things, and we have become accustomed to accept such average speed as sufficient, or perhaps as the best obtainable. It is, however, altogether insufficient, and we consider that the housing requirements are such that special tracks should be provided upon sufficiently wide roads, so that the maximum speed along these exclusive tracks should reach a maximum of thirty miles per hour."

If cheap fares are combined with swift travelling cars, substantial service will have been rendered by the tramways department in solving the housing difficulty. People will be encouraged to make their homes beyond congested areas, and the travel habit will continue to increase. The travel habit has increased tremendously owing to the introduction of electric traction, and with the further facility of high-speed tramway cars the population will be spread over much of the land at present undeveloped.

THE IDEAL OF THE TRANSPORT ENGINEER.

Cheap and rapid transit facilities will do more. They will encourage the opening of new works areas in the districts designed to be placed beyond the outer ring road.

Mr. Thomson's printed report contains a series of maps, shown in colour, each designed to bring out particular aspects of the present condition of Dundee, and the improvements adumbrated in the scheme. Map No. 1 shows, by graded shading, the degrees of congestion in the city. On Map No. 2 the railway facilities are illustrated. Map No. 3 gives the proposed ring road, with added arterial roads, and the presently existing thoroughfares. Proposed open spaces, parks, and park roads are indicated on Map No. 4. A scheme of land reclamation on the river front is the main feature of



Example of Town Planning with Tramways.

Map No. 5, the traffic routes made possible by the scheme being included. Map No. 6 flourishes before the eye the greenery to be introduced into the grey spaces of Dundee.

On Map No. 7 the city engineer shows the existing lines of tramways, the tramway extensions on the main roads, and the ring road which may be carried out by instalments, serving the land which it is suggested should be laid out for industrial undertakings, housing, parks, open spaces, and main thoroughfares, and which should be provided with transit facilities. This land cannot be successfully developed, nor appropriately allocated for works areas and housing without, at the very outset, providing a comprehensive plan of tramway extensions which can be adhered to as part of the general plan of tramway extensions for the expansion of the city. And it may be confidently assumed that apart entirely from the many recognised transit advantages of good tramway service, there will be the further benefits of the possibility of adding to the

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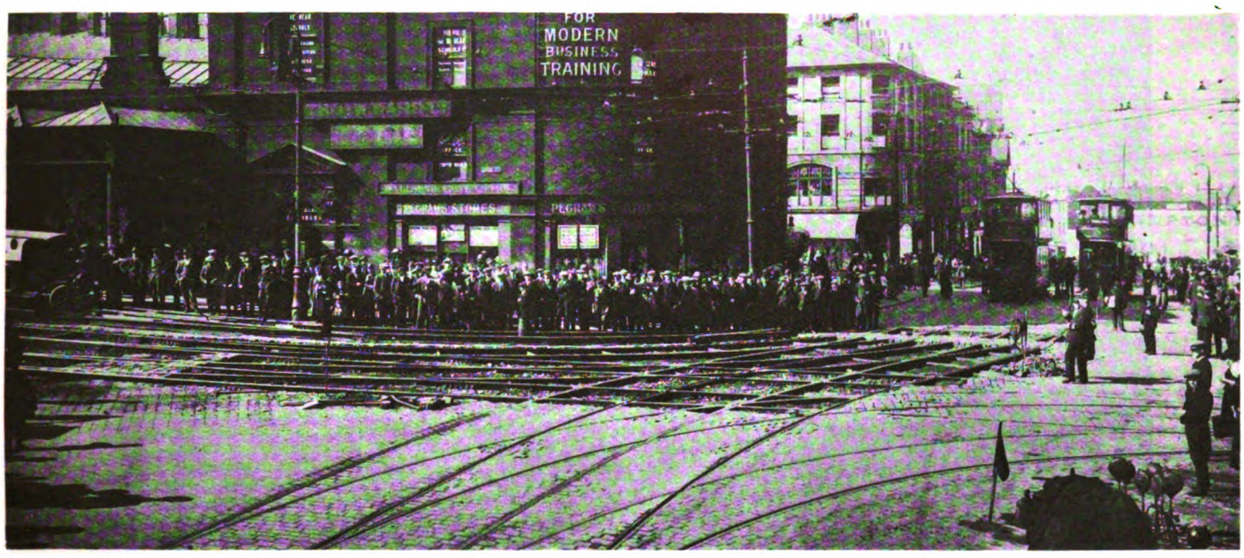
population without increasing the density, of the placing of public works and industrial undertakings on healthy sites, of a substantial contribution to abolition of slums, of encouragement to citizens to get to the open country, and of the consequent improvement of public health.

The whole scheme of development it is proposed should in the meantime be spread over fifty years. Within that period many changes must be effected and improvements carried out, but it is hoped that in the immediate future substantial forward movement will be made.

Prepared from the standpoint of civic amenity, this Dundee improvement scheme is an impartial testimony to the essential part which tramways must play in the future development of town planning. Without tramways, or other means of rapid transit, all such schemes are wholly impracticable. The fundamental principle is extension of area, which involves increased need for transit and that at greater speed. Cost of transport is the economic cause of town congestion, and to be economically sound any town planning scheme must include the means of transport which shall reduce the cost of extended travel to the lowest minimum. Other factors enter, of course, but the ideal of the transport engineer is to make his undertaking an economical acquisition to the community which it serves.



Relaying Fitzalan Junction—Sheffield Corporation Tramways.

FITZALAN SQUARE JUNCTION, SHEFFIELD CORPORATION TRAMWAYS.

One of the most striking examples of the remarkable wear resisting properties of Hadfield's managanese steel is afforded by an important layout in connection with the extensive system of the Sheffield Corporation Tramways. This is situated in Fitzalan Square, the centre of the city, from which the tracks radiate in all directions. The system is so arranged to provide a through service of cars, and owing to the location of this special layout, practically the whole of the cars pass over it.

The information we give below is of special interest, as it shows how economy in upkeep can be effected and how to minimise the delay caused by dislocation of traffic during reconstruction, this being a most important consideration in all industrial centres. It is quite obvious that the frequent replacing of rails at this important part of the city was out of the question, in fact impracticable—that is to say, the roads could not be closed to traffic.

In the early days of electric traction in the city, this junction was constructed throughout with rails, points, and crossings of ordinary steel, but owing to the super-elevation of the layout the amount of wear was so abnormal that the rolled carbon steel rails and other parts had to be renewed every few weeks, whereas after several years' service the amount of wear on the "Era" manganese steel construction, made by Messrs. Hadfield's Limited, Sheffield, was scarcely appreciable. Thus it is quite correct to say that without this special material the through service could not have been maintained except with the greatest difficulty and abnormal expense.

The first junction layout in Hadfield's Patent "Era" manganese steel supplied for Fitzalan Square was in 1901. Its condition was carefully recorded up to the date of renewal in September, 1907, when it was replaced, not because it was worn out, as it was admittedly fit for several years further service, but had to be removed to meet the demands of the greatly increased car service and the necessity to re-design the junction so as to provide for additional tracks. The second "Era" manganese steel layout was laid in September, 1907, and has recently been relaid without interference with the car service or general traffic under the supervision of Mr. W. J. Hadfield, Sheffield City Engineer.

The following data respecting the two layouts demonstrate the supreme wearing qualities of this material :—

	First Layout Laid Sept., 1901 Replaced Sept., 1907	Second Layout Laid Sept., 1907 Replaced May, 1919
Average number of cars per day	2,700	3,510
Tonnage per day	27,000	30,000
Maximum vertical tread wear per 10,000	·0021 in.	·0028 in.
Total vertical tread wear in six years	·484 in.	·781 in.
Total number of cars that passed over the junction	5,225,000	13,500,000
Number of points	8	16
Number of crossings	18	28
Number of intersections	28	40
Number of rails	47	59
Number of years' wear	6	12
Total weight of layout	20 tons	33 tons

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TRAMWAY CAR ELECTRIC LIGHTING.

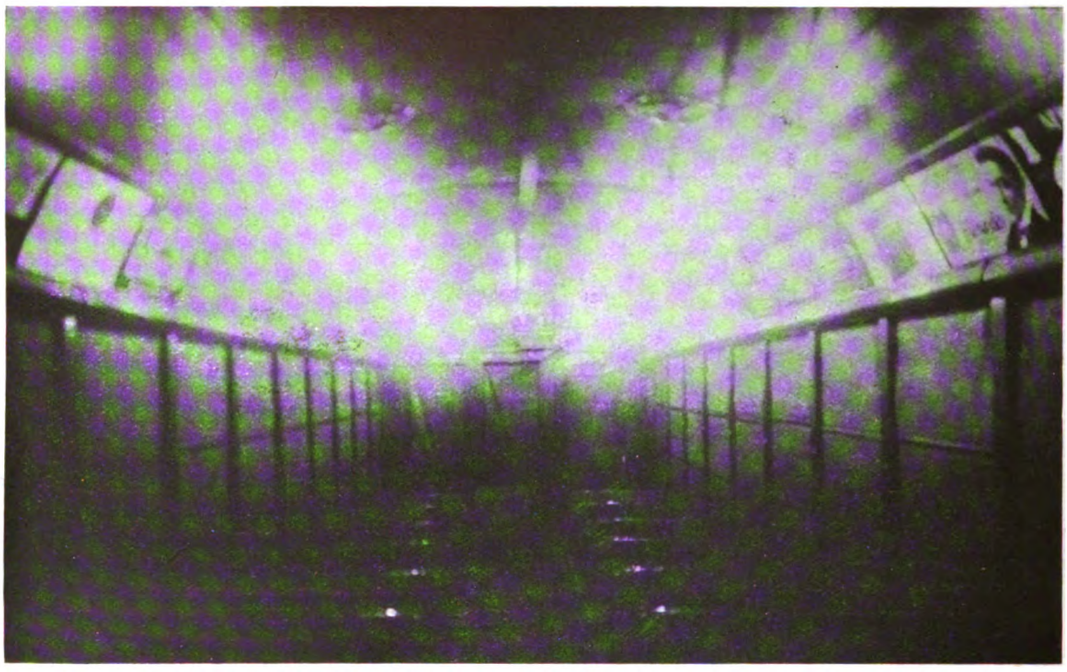
Air raiders have long ceased to threaten life and property with bombs from the sky, lighting restrictions have been removed, and the numerous brood of orders and regulations apparently designed to convert law-abiding citizens into criminals have vanished into the limbo of useless things. Now that the period of darkness is past, the opportunity of the illuminating engineer has come. Before the war the lighting of tramcars was far from perfect, though the carbon filament lights distributed along the sides of the car marked an advance on smoky lamps fixed in dim recesses at each end, making darkness visible.

Improvement in the lighting of tramway cars is desirable, expected, and highly possible. A leading tramway engineer recently said that the light wiring on most cars had been worn out, and was constantly liable to breakdown. There is all the more reason therefore for a new start being made in that direction. The unshaded carbon filament lamps at present largely in use can hardly be accounted the last word in tramcar lighting. On the contrary, the method is quite out of date, and metallic filament lamps have established themselves in the lighting field. Anyone looking into a car lighted with unshaded lamps can see that the light is almost wholly concentrated in a strong glare near the roof of the car, the rest of the interior being in shadow. Accompanying is the reproduction of a photograph of a car interior lighted with the carbon filament lamp. Only by careful scrutiny is it possible to discern the seats of the passengers, and it needs no great exercise of imagination to understand the discomfort which such a mode of lighting inflicts on the car-users. There is plenty of light, but it is not properly distributed, and that is the whole trouble.

It is unnecessary to argue that the metallic filament electric lamp is superior to the carbon filament type, but demonstration of the admitted fact may not be wholly superfluous. On the opposite page two illustrations show a system of electric car lighting employed at Toledo, Ohio, by the Toledo Railways and Light Company. The car shown in photographs reproduced is equipped with tungsten lights and suitable reflectors. As may be seen, the new method sheds a beautiful glow of diffused light throughout the whole compartment, effectively illuminating every detail. Even the floor is visible, and the seats stand out with clear distinctness. Glare is absent, and there is sufficient light for comfortable reading.

All three pictures were taken under precisely the same conditions—on a dark night, with the curtains of the cars closely drawn, so that the only light seen is that coming from the lamps. It is also affirmed that, while giving three times the illumination of the old method, the new system uses only about one-third of the current required when carbon filament lamps are employed.

The Toledo cars have an inviting interior, seen under the diffused light of the tungsten lamps, and there is one detail which is rather notable. Depending from the strap rail there are substantial straps with handgrips made of porcelain. Not only do these handgrips afford the passenger a solid hold, but they are also easily cleaned, and do not absorb the sweat and dirt from the hands of those who use them.



Old Style Tramway Car Lighting—Unshaded Carbon Filament Lamps.

MELBOURNE RAILWAYS ELECTRIFICATION.

On May 28 electric service on the Sandringham-Essendon section of the Melbourne Suburban Railways was publicly inaugurated by the Hon. W. A. Watt, Acting Prime Minister of the Commonwealth, the Prime Minister of Victoria, and the Minister of Railways. From a cablegram received from Melbourne it appears that everything worked with perfect smoothness, and that the popularity of the electric service is assured. This first section is 20 miles in length, but the whole system of railways being electrified includes some 150 route lines.

It will be remembered that German manufacturers made a great effort to have the single-phase system adopted, but when it came to a comparison based upon actual tenders, the 1,500-volt direct current system which was ultimately chosen proved much the cheaper both in first cost and in operation. The work began in 1913, and has been carried out for the Victoria Railways Commissioners under the supervision of Messrs. Merz and McLellan, consulting engineers, Westminster.

The principal contractors were :—Babcock and Wilcox, Limited, C. A. Parsons and Company, the Weymouth Proprietary, Limited (Melbourne), the General Electric Company (New York), the British Insulated and Helsby Cables, Limited, and Siemens Brothers' Dynamo Works, Limited.

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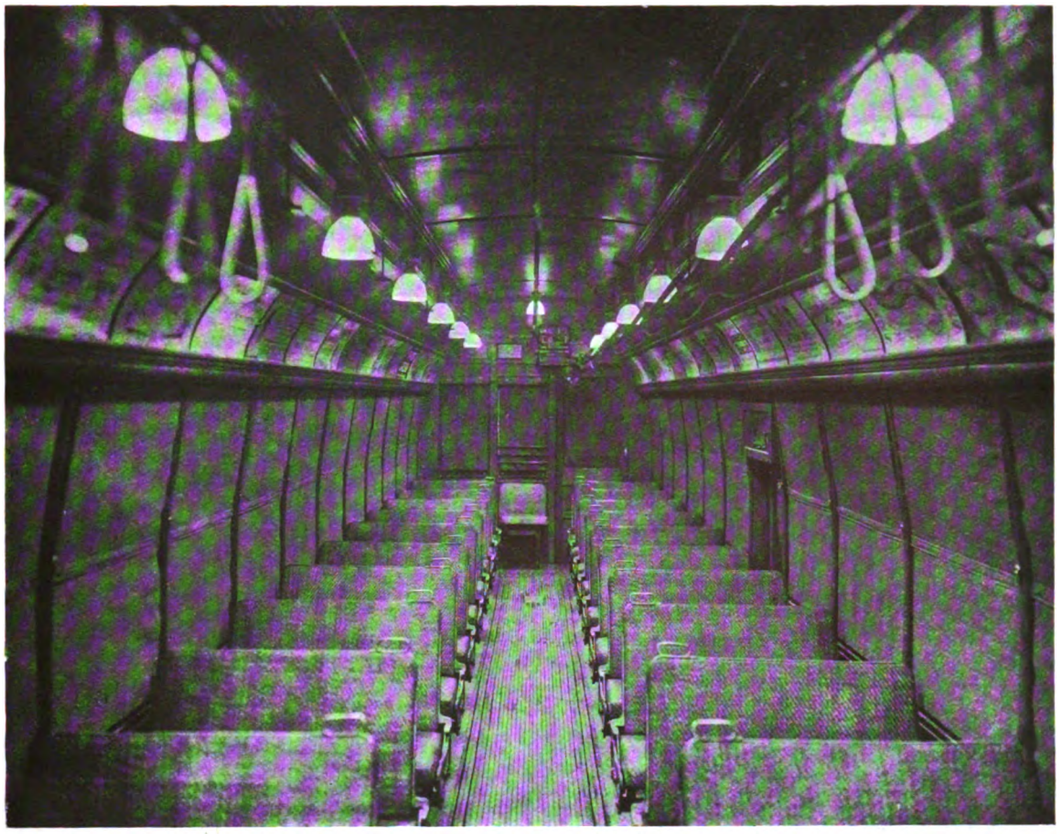

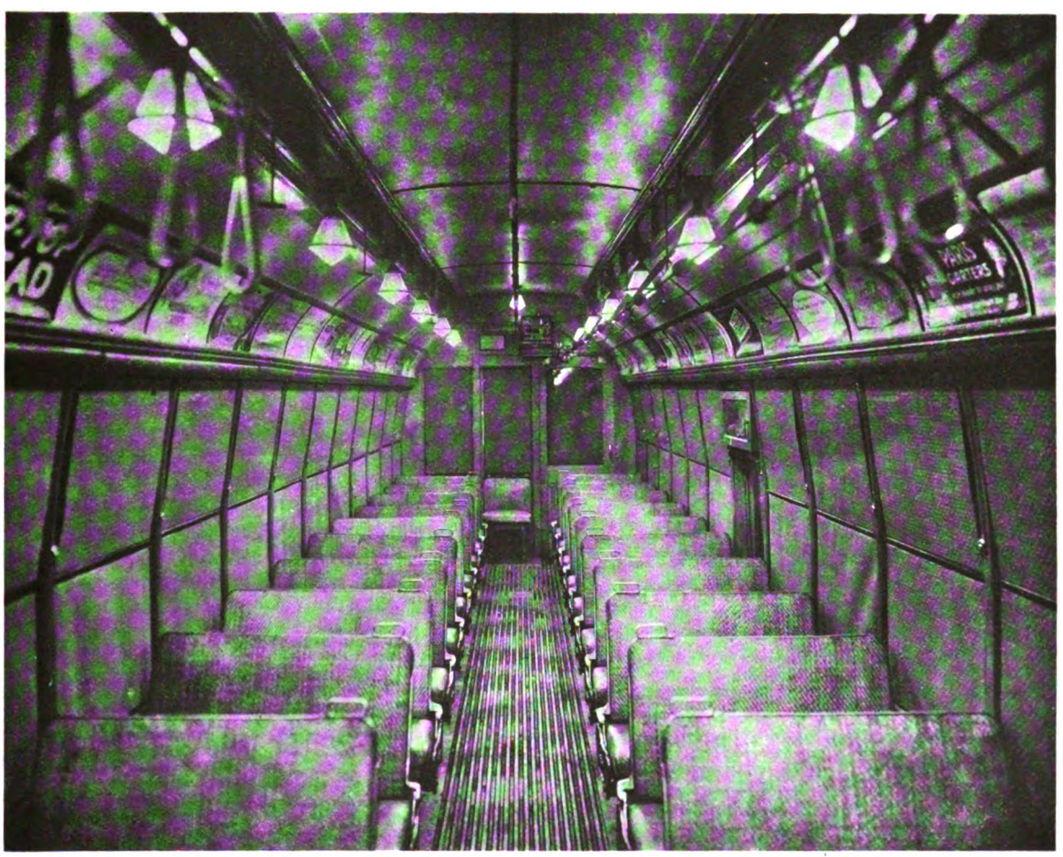

Modern Tramway Car Lighting—Metallic Filament Lamps Correctly Shaded.
[Note also the Sanitary Porcelain Hand Grips.]

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THE SANDBERG "IN SITU" RAIL HARDENING PROCESS.

By Robt. B. Holt, M.I.Mech.E.

A full description of the Sandberg system of sorbitically treating existing tramway rails appeared in The Tramway and Railway World of April 11, 1918. Since that date, however, extensive contracts have been entered into with the following tramways:—Croydon, Metropolitan (London), Manchester, Birmingham, Bournemouth, Liverpool and Glasgow, both for the treatment of entire lengths of track, curves subjected to excessive wear, and rail joints. Repeat orders have been obtained from Croydon, Metropolitan (London), Manchester, and Birmingham. The development of the commercial side of the patent by Messrs. Scholey & Co. Ltd., 56, Victoria Street, London, S.W., the licensees, has only been limited by the scarcity of labour, plant, and materials; the number of inquiries received indicates clearly the urgent need for a means whereby the life of existing tramway rails can be prolonged.

In the former article mention was made of the initial experiments carried out on the Leeds Corporation Tramways with this process. The experiments in question were of a drastic nature, and lengths of treated rail were subjected to, and withstood, very severe physical tests before the treatment was applied to rails in the track. The laboratory tests included:—

(1) A fifty-ton pressure test on a 19-mm. steel ball placed in the centre of the rail tread, without producing any appreciable indentation; it is interesting to note that in two instances the hardened steel balls themselves fractured under the load.

(2) The standard Brinell test, which indicated that the hardness of the treated surface was almost double that of the metal half an inch below the surface.

(3) Etching and microscopic examination at high magnification which disclosed the important fact that there was no sudden line of cleavage between the under side of the treated metal and the body of the rail tread, but that the change was gradual through the usual ranges of molecular disposition.

(3) Rails were subjected to continuous power hammer tests at frequent intervals throughout their length; the weight of the blow being one hundredweight, and as many as two hundred blows being applied to one spot with the object of detaching the treated surface. This test, and similar tests with the same object, failed to break away any portion of the hardened rail face, and moreover the indentations on the rail were of a negligible character.

(5) Specially hardened cold chisels, when applied to the treated metal with a three-pound hammer, either turned up at the edge or the edges broke away without producing more than superficial scratches.

In consequence of the satisfactory nature of the laboratory tests, short lengths of rail were treated in the track, and careful gaugings from previously prepared "datums" to the nearest half millimetre, before and after treatment, indicated that the process was in no way liable to set up expansion stresses. Following upon a series of minor applications of the process, several hundred yards of track were treated in different positions on the track, and the position to-day, after two years in service, and, in one case, after the passage of close upon a quarter of a million cars, is that the wear on the treated rails is so slight as to defy practical measurement, whilst the adjoining untreated length of the same rail shows $\frac{1}{16}$ in. more wear. The advantages of the "*in situ*" process are plainly manifest, and their value cannot be overestimated. One interesting experiment carried out exactly two and a quarter years ago in Leeds indicates that after the passage of 360,000 cars the rails treated by this process, whilst subjected to precisely the same influences which cause adjoining lengths of the same rail to corrugate, remain unaffected. Evidence that the treated rails are subjected to the same influences which cause the untreated rails to corrugate is apparent, under certain climatic conditions, in the formation of corrugations in the greasy mud film covering the tread of the treated rails.

The accompanying illustration gives a view of the treated and untreated portions of the same rail, the corrugations on the untreated portion being clearly discernible. The rail in question is on a curve of 300 feet radius, and before being treated the corrugations were entirely removed from both the treated and untreated portions. As previously stated, pronounced corrugations have reappeared on the untreated portion whilst the treated portion is immune.

Showing Effect of Wear on a Part of a Rail which has been Treated Sorbitically and a Part Not so Treated.

A similar experience is reported from Birmingham, where corrugations were removed from a length of rail, part of which was afterwards treated by the "*in situ*" process. Up to the present time there is no trace of corrugation on the treated portion, whilst very marked corrugations have reappeared on either side thereof on the untreated portion.

In introducing the "*in situ*" treatment, the licensees have been confronted with a number of pertinent queries in regard to the possible effect which the hardening of the rails may have upon adhesion and braking, welded joints, etc., and it is desirable that the replies to these questions which can be made should be generally known.

In developing the "*in situ*" process particular attention has been paid to the possible loss of adhesion due to the production of an over-hard rail surface, and from experiments carried out under actual service conditions it is evident that no trouble is to be apprehended in this direction. The greasiness of rails under certain atmospheric conditions renders braking a skilful operation, but this condition is common to all qualities of rail steel, and the "*in situ*" process in no way accentuates the difficulty.

The same may be said in regard to coasting on

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gradients, particularly without the use of track brakes; the conditions governing retardation and safety depend principally upon the human element, i.e., upon the skill and resource of the motorman, independently of the wheel and rail contact, and in such instances, whether the rail surface be hard or soft, the judicious use of brake sand is essential.

Unfortunately, from several points of view, tramway rails are never free from road detritus, and a clean contact between wheel and rail is rarely, if ever, obtained. This condition is one which contributes, to a much larger extent than is generally understood, to the rapid rate of wear of tramway rails and wheel tires. The fact is that there is excessive adhesion between tramway wheels and rails in full contact—due to the presence of detritus—and the effect of hardening the rail surface by the "*in situ*" process is to increase the resistance to rapid wear without loss of efficient adhesion. It is well known that no difficulty has been experienced in regard to adhesion and mechanical braking on manganese steel rails—a fact which speaks for itself.

In order practically to demonstrate that the effect of the hardening of the rails by the "*in situ*" process is not conducive to wheel slip, experiments have been carried out by operating a car on an up-gradient, over a length of track a portion of which had been treated by the "*in situ*" process, with the front motor cut out and with the brakes applied to the front wheels; the slip of the rear or driving wheels was continuous, and no more pronounced on the treated length of track than on the other portion.

The "*in situ*" treatment may be applied to rails with welded joints without detriment to the joints. As it is instantaneous at any one point, the heat applied does not approach the welding temperature, and does not penetrate deep enough to injure the weld.

The question of the depth and regularity of the treatment occasionally arises, and in connection with this it may be said that these conditions depend largely upon the composition and structural condition of the rail itself. The depth of the treatment is dependent upon the heat conductivity of the rail, and hardness and uniformity will vary according to the percentage and disposition of the carbon in the steel. Original irregularities of this description will in no way be accentuated; in fact, the treatment is such as to neutralise inherent defects of this character.

It has been suggested that once the hardened surface has been worn through, irregular wear will occur in consequence of the minor variations in its depth, a condition inseparable from the tempering of steel; but actual results indicate that owing to the resistance to wear the life of the rails will be prolonged to such an extent as to render the possibility remote and beyond the scope of the present economical aspect.

The interest in the process is general; the contracts already secured from some of the largest undertakings in the kingdom, the increasing number of repeat orders, and the extensive list of negotiations at present being completed is sufficient evidence that the exceptional economical possibilities of the treatment are appreciated.

In view of the high cost of rails, track materials, and labour it is obvious that the "*in situ*" process, ensuring as it does a greatly extended life to the rails, and a decidedly retarding effect on the development of corrugations, will prove an attractive practical and commercial proposition to tramway undertakings.

INTERNATIONAL TRAMWAYS UNION.

Reorganisation After War.

The following communication, signed by the president, M. C. de Burlet, and the general secretary, M. H. Camp, has been sent to members of the Union Internationale de Tramways et de Chemins de fer d'Interet Local, from the offices, Rue d'Arlon, 23, Brussels:

It is with a feeling of profound satisfaction that the Executive Committee, after a long and painful separation, is again able to renew communication with the members of the Union. The events of the terrible war have left their mark upon our association, and radical changes are necessary in order to maintain the Union and to ensure that the results of collaboration, already far too long interrupted, are not irretrievably lost. In taking account of the new situation, the Executive Committee, at their meeting on March 22 last, decided that the only possible solution was to be found in disbanding the Union and in re-forming it immediately with members only of the allied and neutral countries. A general assembly being felt to be impossible at that moment, the Executive Committee assumed the responsibility of proposing the measure, leaving it to be ratified as soon as circumstances permit.

Thanks to the care with which our predecessors managed the finances, the Executive Committee, which has directed the business of the Union during the period in which the office of the association was separated from the greater part of the members, have found the necessary funds to maintain the organisation. This result has been obtained by careful economy, and in spite of the fact that since 1914 no subscriptions have been received. The intention of the Executive Committee is to renounce the annual subscriptions for the years 1915, 1916, and 1917, but in order to permit the resumption of our work and the sending of reports, documents, etc., the committee invite members to send to the general secretary the subscriptions due for the years 1918 and 1919.

Article 12 of the statutes fixes the sums to be paid by the Corporation or company members on the following scale:—

For annual receipts—	Per annum
(*a*) Of not less than 1,000,000 fr...	50 fr.
(*b*) From 1,000,000 fr. to 2,000,000 fr.	100 fr.
(*c*) From 2,000,000 fr. to 3,000,000 fr.	150 fr.
(*e*) From 3,000,000 fr. to 4,000,000 fr.	200 fr.
(*f*) From 4,000,000 fr. to 5,000,000 fr.	250 fr.
(*g*) Above 5,000,000 fr.	300 fr.

The annual subscription for effective personal members and associated members is 20 francs, and for associate members, firms, etc., interested in the tramway industry, it is 100 francs.

Considerable changes are or will be inevitable in the domain of tramways and light railways, as in all other branches of industry, and it is of the highest importance at the present time that firms and persons concerned in this industry should exchange experiences. The committee therefore count upon the active co-operation of all the members. They are happy to state that marks of sympathy and expressions of ho[illegible] of the revival of our association have been receiv[illegible] the office from various quarters.

The Committee hope to meet with the [illegible] ments among all their members, and [illegible] commenced thirty-four years ago [illegible] for the greatest good, not only of [illegible] takings but of all that grea[illegible] directly interested in the d[illegible] port.

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THE EDITOR will be glad to consider articles by experts. All information of a practical character relating particularly to the engineering and operating branches of transportation will receive prompt attention. Original illustrations will also be welcome.

LONDON, JUNE 19, 1919.

Supply of Electricity. The terms of the Electricity Supply Bill are now before the country, and as was to be expected their reception has been somewhat mixed. There is, of course, no difference of opinion as to the desirability of providing the country at large with an abundant and cheap supply of electricity for all purposes. Criticism arises on the methods, and in a complex scheme which touches so many interests numerous differences of opinion are only to be expected. Speaking generally, the scheme, if properly worked, is calculated to attain the desired end, but there are possibilities of failure or only partial success in the fact that so many of the powers conferred on the new bodies to be set up are permissive, not mandatory. The word "may" flourishes all over the Bill; "shall" is much less in evidence. It is quite probable that the explanation is that in this way the Government hope to disarm much of the opposition to the Bill, particularly that from local authorities. Indeed, some of the municipalities are, we believe, of opinion that their case has largely been met, and no doubt further attempts to enforce that case will be made at the Committee stage of the Bill. Another branch of opposition to be reckoned with is that of power companies, engineering bodies, and some classes of manufacturers to the creation and powers of the proposed District Electricity Boards. There is less objection to the central general controlling body, the Electricity Commissioners, but in the District Boards the supporters of individual initiative and enterprise see an enormous development of bureaucratic government and possibilities of hindrance and stagnation. It is unfortunately true that any national scheme under State auspices is open to objections of the kind; we have another example of it in the Ministry of Ways and Communications Bill. At the same time, if we are to have organisation, co-operation, efficiency, economy, and development on a national scale, something must be risked, and the tendency of the times is to risk it. Parliamentary control will always be available, and when so much in the practical direction is at stake, it ought to prove more efficient than it has often been in the past.

The Bill and the Experts. It may be noted that some controversy may arise in connection with the points on which the Bill differs from the recommendations of the three committees of experts who reported to the Government on the subject. The Electric Power Supply Committee, over which Sir Arch. Williamson presided, and which made the proposals for the organisation that is largely embodied in the Bill, was advisedly described by the Home Secretary when moving the second reading as a very powerful Committee, representative of practically every industry interested in electricity. Sir A. Williamson himself, speaking in the debate which is reported in this issue, specially criticised the proposal of the Bill that the country may be divided into electricity districts, instead of (as proposed by his Committee) shall be so divided. He pointed to the danger that one part of the country might be divided and another part not divided into districts under District Boards. He also objected to local financing, holding that it should be national in the first place. Probably there will be much to say on these as

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well as other matters. Nothing definite has emerged so far as to the effect of the Bill on power supply for tramways and railways in particular, but that aspect, like others, will no doubt be discussed in Committee. To get the Bill passed this year will require good-will and conciliation. On the single question of transferring all powers of the Board of Trade under the Bill to the Minister of Ways and Communications strenuous opposition is threatened by those who have so keenly criticised the Bill for the establishment of that Ministry.

London Traffic Board Wanted.

In human affairs, neglected opportunities often come back in the shape of dire necessities. The present condition of London transport facilities is another instance. In 1903 the Government then in power appointed a Commission to inquire into London traffic conditions, and two years thereafter the Commission issued its report. Nothing was done. The report, which, including the expense of the Commission, cost £20,000, not to speak of the endless labours of able men, was shelved. One of the principal recommendations of the Commission was the appointment of a London Traffic Board, and the proposal suited nothing but the public interest. Politicians considered that there was little to be gained by them from the setting up of a non-political body such as was proposed, and they played for safety by a policy of careful inaction. As a matter of fact, neither the Progressive nor the Moderate party in the County Council were enamoured of the proposal, as it would introduce a body of experts whose views would not be subservient to the exigencies of party politics. Moreover, the influences in the city, the interests of the railways and other transport companies were then dead against it. During the years between 1905 and 1914, the mutually confusing and contradictory activities of the authorities directing the tramway, tube, railway, and omnibus services continued, creating a problem growing ever more formidable. It is useless to blame the war for the trouble. One might even maintain the proposition that, but for the war, the congestion of London traffic would have been worse than it is, and support the argument with strong proofs. A Traffic Board, almost any kind of Board—democratic or bureaucratic, autocratic or plutocratic—would have done something to improve the conditions of London traffic, and certainly prevented the evil from attaining the proportions it has reached in the absence of any control whatever. Absence of an active public spirit in London is the root cause of the whole difficulty. The Metropolitan district is a conglomerate of business places and workshops and domestic habitations and dormitories. Unification of the two ideas in one conception of London citizenship has yet to be attained by the vast majority of the people of all classes. Under such circumstances self-government by elected representatives is an illusion and a sham. In consequence, London local government has become the battleground of contending factions. One party dislikes the exercise of municipal enterprise, and pursues the aim of destroying the County Council Tramways department with unwearying hostility. Another faction aims at municipalising every service, but is unable to construct a plan which will effect the purpose without trenching upon the rights of free citizens. And now Labour has come up to demand control of all public services in its own interest. Is it not time we had done with all that, and the sane, freedom-loving, ordinary Englishman had his say in the matter? There is no essential opposition between the different forms of transport service at present existing in London. The tramways are a vital necessity to London life, and they need, as the London County Council has now admitted, the auxiliary of the omnibus. The tube and other railways serve to relieve the congestion of the street traffic; without them London business could not be carried on for a week. Where all are necessary to the common welfare, opposition and competitive hostility are foolish and futile. Co-ordination of all the services, in whatever hands the various sections may be, is imperatively demanded by the need of the whole community. However imperfect its constitution might have been, had a London Traffic Board been set up in 1905 it would very largely have averted our present troubles, and taken the necessary action under pressure of public opinion. To London citizens has come the

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rare good fortune of a second opportunity in the appointment of a Select Committee to investigate their needs and to explore all avenues of improvement. Upon the committee rests a heavy responsibility, but in the present condition of London transport their work can hardly fail to result in benefit to a sorely tried public.

The Select Committee on London Transport.

The relegation to a Select Committee of the House of Commons of the task of reporting upon the increases of fares and the overcrowding upon the London Underground Railways, the County Council tramways, and the omnibuses, is to be welcomed because it will enable the several cases to be inquired into in an efficient manner. That result was not achieved by the proceedings before the Committee of London Members, who, according to a statement made to an interviewer by Mr. Purchase, their joint secretary, came to the decision that "although a case had been made out by the undertakings, their general impression was that the case had not been fully made out." On the whole it may be affirmed that the railways and the omnibuses came out of the informal inquiry better than the County Council did. A contributory cause was that the traffic group had put the public in possession of the features of their case before the inquiry took place, and continued to do so during the sittings. For this result credit is due to their publicity department, whose many years' experience of the value of displayed advertisements in newspapers had taught them that the public quickly appreciate facts when properly placed before them. Therefore it was not surprising to observe that the companies kept the public informed of the difficulties which they have had to encounter in the form of increased labour costs, shortage of rolling stock, and the enhanced charges for fuel and materials. This method of appeal by the owners of public utility services has long proved a success in the United States, and it is surprising that the County Council were not awake to its importance, instead of advertising facilities for reaching Hyde Park and Hampstead Heath. One circumstance disclosed by the evidence of chairmen and officials, and also by the advertisements, leads us to ask the reason why all the undertakings refrained from calling a spade a spade in regard to one of their chief burdens. Apparently in no case was the eight-hour day mentioned as such. Its bearing upon the difficulties of the County Council is shown by the fact that the 48-hour week is estimated to involve an outlay of £360,000 per annum, and that an increased revenue of over a million pounds has to be secured during 1919-20 in order to meet the expenditure and usual charges. It will be necessary also when evidence is given before the Select Committee for the representatives of the Council to be agreed upon the proportion of the increase in the cost per car-mile due to material and labour charges respectively. When that question was raised at the recent inquiry, the tramways manager replied that approximately one-third of the increase is due to labour, while the chairman of the Highways Committee stated his impression that it is two-thirds. If the public possessed as clear a knowledge of the facts as Sir A. Geddes' reply to the London Members' deputation disclosed upon his part, there would be no need for further inquiry. It should be accepted, however, as being likely to emphasise in an overwhelming manner the necessity for the setting up of a London Traffic Board. As the President of the Local Government Board remarked to the deputation, "the whole position shows how lamentable is the lack of a transport authority to deal with these things."

LONDON TRAMWAY EXTENSIONS.

At a meeting of the London County Council on June 3, it was decided to proceed with the construction of authorised tramways in Wandsworth and at Lee Green. Both extensions were decided upon in July, 1914, but the work had to be postponed owing to the war.

The Wandsworth extension comprises tramways in High Street and East Hill, and a junction line from High Street to the Garratt Lane tramways, the original estimated cost being £26,000. In 1914, owing to difficulties in connection with certain street improvements, it was not possible to proceed with the whole of the tramways, but tenders were invited, and the offer of John Mowlem and Company, Limited, was accepted for a part of the tramways in East Hill between the existing terminus and Fairfield Street. Revised estimates prepared on the basis of present prices are as follows: Track work, including rails, special work, paving and alterations to mains, £46,400; sub-station equipment, £120; cables, £500; ducts, £150; feeder pillars, £100, making a total of £47,290.

By the Eltham extension the Lee Green tramways communicating with the Thames Embankment, *viâ* Blackfriars, will be taken to the London County Council boundary in that part of the south-eastern district. At Eltham the extension will join the tramways which run to Woolwich. If the extension had been carried out during the war it would have greatly facilitated the transport of workers to the Arsenal. The capital estimate in 1914 was £57,025. The estimates now framed give a total of £134,710, made up as follows:—Track work, including rails, special work, paving and alterations to mains, £98,000; sub-station equipment, £360; overhead equipment, £10,000; car equipment, £2,340; cables, £17,730; ducts, £5,880; feeder pillars, £400.

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JOINT INDUSTRIAL COUNCIL FOR THE TRAMWAY INDUSTRY.

A Preliminary Committee.

Under the terms of the agreement of March 20, 1919, between the tramway undertakings and the employees, which were given in our issue for April 10, 1919, it was provided that, pending the final establishment of the Joint Industrial Council, a Joint Committee should be set up. This Joint Committee consists of six members representing the employers and six members representing the employees, including three representatives of the Municipal Tramways Association, three representatives of the Tramways and Light Railways Association, and six representatives of the National Transport Workers' Federation.

Two meetings of the Joint Committee have been held, one at Birmingham and one at Sheffield on May 8. At the first meeting, Mr. A. Baker, general manager of the Birmingham Corporation Tramways, was appointed chairman, and Mr. E. Bawden, president of the Amalgamated Association of Tramway and Vehicle Workers, was appointed vice-chairman.

The Joint Committee have decided upon the following rulings, which have been published in the May issue of the *Tramways and Light Railways Association Journal*:—

War Bonus.

That it be understood that as from the settlement of the agreement the 30s. war bonus be paid in respect of the reduced working week of 48 hours.

Clause 1 (*a*).—That the words "working week" shall be deemed to mean six days. That the words "signing on" and "signing off" shall be deemed to mean the same periods as now in vogue in respect of these allowances.

Clause 1 (*b*).—Regarding permanent way men whose hours of labour vary during certain periods of the year, the principle to be adopted of totalling up the number of hours each week for the whole year and then taking the average.

Clause 1 (*b, c, d*).—Regarding any other matters arising in connection with Clauses 1 (*b, c, d*), these to be dealt with as and when occasion arises.

Clause 2.—It having been suggested that the clause be interpreted to include every employee in the tramway industry whose working conditions are not governed by any other Trade Union, it was decided that the question be left over to be dealt with if a difference arose in any particular undertaking.

With regard to permanent way men who are "rained off," it was agreed that in the event of rain the employers should be at liberty to call upon the employees to continue to work; if they refused they would forfeit their claim to a full week's pay, or the employers could transfer them to such other work as might be suitable for them.

With regard to the guaranteed working week affecting undertakings where it had been the custom to close the depots, or to stop permanent way men during certain holiday periods without pay, it was agreed that those conditions be considered sasqui valent to those under Clause 10, and that the undertakings hould b e at liberty to continue these arrangements as heretofore without incurring liability for payment of a full week's wage.

It was agreed that the clause should only apply to permanent way men who are recognised as being on the regular staff.

With regard to "watchmen," it was agreed that the agreement be deemed not to apply to these men, but that their hours of labour should not be lengthened, nor their conditions made worse due to the granting of the new conditions of employment to other employees.

The question as to the method of dealing with overhead equipment and other men who worked on shifts was discussed, and it was agreed that these men should be paid Sunday rates for any work they are called upon to perform between midnight Saturday and midnight Sunday; that night staff employees be paid Sunday rates for any work carried out by them between midnight Saturday and midnight Sunday.

The Joint Committee decided that the bonus should be taken into account in the calculation for payment of "special rates" or "added time," that is, Sundays, Bank Holidays, Christmas Day.

Procedure.

The question was raised as to whether the Committee were in order in proceeding to interpret the agreement clause by clause, or whether they should simply deal with cases referred to them where difference had arisen.

It was resolved that this committee be deemed to be the "Joint Committee" referred to in Clause 1 (*d*) and Clause 12 (Terms of Agreement, March 20, 1919).

It was resolved that the various undertakings be advised that it is open to the National Transport Workers' Federation and its constituent unions to approach any undertaking in order to settle any dispute arising out of the terms of agreement, and that, failing settlement, the matter be referred to this Joint Committee, subject to such settlement not being prejudicial to the principles laid down in the agreement.

CONFERENCE OF TRAMWAY COMPANIES AS EMPLOYERS.

Constitution Adopted.

A standing conference of company employers who are members of the Tramways and Light Railways Association has been formed, with the following constitution:—

(1) The name of the conference is "The Conference of Tramway and Light Railway Companies."

(2) The objects of the conference are (*a*) to carry on negotiations and arrange agreements with the Government, trade unions, and others upon questions arising out of labour problems, including questions of wages and war wages; (*b*) to elect members as representatives of companies to the National Industrial Council for the tramway industry; (*c*) otherwise to represent companies in such matters concerning the tramway and light railway industry as do not fall within the scope of the objects of the Tramways and Light Railways Association.

(3) The office of the conference shall be the office of the Tramways and Light Railways Association, or such other office as the conference may from time to time determine.

(4) The secretary of the Tramways and Light Railways Association shall act as first secretary to the conference. The secretary shall be remunerated for his services out of the funds of the conference.

(5) The members of the conference shall be duly authorised representatives nominated by tramway or light railway companies in the United Kingdom, being members of the Tramways and Light Railways Association. Each company shall be entitled to one representative, and each representative or member of the conference shall have one vote in respect of each company he represents on any matter put to the vote by the conference. Voting shall be by show of hands or otherwise as the conference may determine.

(6) The conference may carry on its business either by meetings to which all members shall be summoned, or by means of committees or otherwise, as the conference may think fit.

(7) All committees shall report to the conference before any action is taken on matters connected with Labour which may be intended to be binding upon the companies represented by the members of the conference. No company shall be bound by any such action of the conference unless that company shall by written notice to the secretary of the conference have consented to be bound by such intended action.

(8) Each company represented on the conference shall as and when requested pay to the Secretary of the conference a call towards the funds of the conference based upon the number of cars owned or worked by such company, or upon such other basis as may be prescribed from time to time by the conference. Provided that no company shall be bound in any one year to pay a larger sum than 10s. in respect of each car owned or worked by such company during that year.

(9) A quorum at any meeting to which all the members of the conference may be summoned shall consist of not less than seven members present at such meeting, and the decision of the conference shall be communicated to all the members.

(10) The secretary shall submit an annual statement to the conference showing how the funds of the conference have been utilised.

Glasgow Corporation Tramways.—The following are the traffic statistics for the Glasgow Tramways department for the year which closed on May 31, compared with the figures for the previous year:

	1918-19.	1917-18.	Inc. or Dec.
Track mileage (single) ...	196½	196½	
Car mileage	25,581,547	26,261,231	— 679,684
Traffic receipts	£1,527,487	£1,404,110	+ £123,377
Traffic receipts per car-mile	14·331d.	12·832d.	+ 1·499d.
Per passenger	·790d.	·782d.	+ ·008d.
Passengers carried ...	464,246,677	430,946,566	+ 33,300,111
Passengers carried per car-mile	18·148	16·409	+ 1·739

The following statement gives the number of passengers carried at each fare:—

	Year to May 31, 1919.	Year to May 31, 1918.
½d.	290,080,376	272,902,138
1d.	121,285,355	110,608,645
1½d.	31,750,977	28,462,112
2d.	10,348,905	9,332,956
2½d.	4,846,252	4,351,666
3d.	2,520,384	2,215,506
3½d.	2,952,145	2,696,504
4d.	462,283	377,039
	464,246,677	430,946,566

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BOURNEMOUTH CORPORATION TRAMWAYS.*

By I. Bulfin, B.A., A.M.I.C.E., M.I.M.E., M.E.E. (General Manager, Bournemouth Corporation Tramways).

The British Electric Traction Company in the year 1899 obtained their Light Railway Order for the construction of 3¾ miles of railway in the Poole area, i.e., from the County Gates Bournemouth boundary in a western direction to Poole Station, and opened the same for traffic in 1901. In the year 1900 the same company promoted a Tramways Act (Christchurch and Bournemouth Tramways Act, 1900) for a tramway connecting Bournemouth and Christchurch in an easterly direction. This latter Act included the tramway from the Hotel Metropole to Pokesdown Station in the Bournemouth area. The Bournemouth Corporation, in view of the B.E.T. Company holding the light railways on the western side and their endeavour to obtain a tramway concession on the eastern side and partly in their borough, determined to apply to Parliament (as a blocking measure) for a Tramways Bill for their own area, and promoted in the same year the Bournemouth Corporation Tramways Order, 1900. Parliament granted powers to the Bournemouth Corporation to construct the lines in their own area, and the line Metropole to Pokesdown in the B.E.T. Company's Act was held in abeyance subject to the Bournemouth Corporation constructing the line within two years. The Bournemouth Bill was only a blocking measure, and the scheme was for a single line and passing places on the whole of the main route, and in view of the fact that, if the tramways were not constructed within two years, their powers lapsed and a company had powers to run trams in Bournemouth area, it became necessary to reconsider the whole scheme and to arrange for a double line right through. This necessitated the widening of roads, compulsory powers for acquiring lands, and the preparation of plans and contracts for a large system, including depots, generating station, etc. The delays occasioned by these alterations and in obtaining the necessary powers resulted in the two years expiring before substantial progress was made, with the result that in 1902 the B.E.T. Company issued an injunction against the Bournemouth Corporation constructing these lines, as their powers had lapsed, and by an Order of the Court of Appeal dated July 15, 1902, this injunction was upheld. In order to retain the tramways in their own area it became necessary to buy out the B.E.T. Company both on the Poole and the Christchurch sides. The case went to arbitration, and a price was fixed and agreed. Owing, however, to trouble with the Dorset County Council, it became necessary for the Poole Corporation to buy the Poole line, and they leased these lines to Bournemouth for a period of 30 years, the Bournemouth Corporation agreeing to pay as rent a sufficient sum per annum to pay interest and sinking fund on the purchase price, and at the expiration of the 30 years' lease the Poole light railway would become the property of the Poole Corporation free of all costs.

The amended Bournemouth scheme for tramways was for a double line of tramways through the whole of the main route run on the trolley system, but in the centre of the town they decided to instal the "conduit" system (being equal to a length of some 2¾ miles of single track). The system was side slot running to centre slot at all special work, identical in every way with the centre slot London County Council system, but laid and run prior to the London County Council system. The conduit system was run for some ten years, when, owing to heavy wear of rails and conductor tees, it became necessary to re-lay this portion of the line, and in going into the cost of renewing same as a conduit system, or changing over to the trolley system, it was decided after very careful consideration of all the points in question to abandon the conduit and run the entire system as a trolley system.

The main lines in Bournemouth were opened to traffic in 1902, and the side routes in 1903. The tramways to Christchurch were constructed by the Bournemouth Corporation, and opened for traffic in 1905, and in the construction of this line it became necessary to buy out the Toll Bridge Company at Tuckton Bridge, over the River Stour (a narrow wooden bridge on iron piles some 380 ft. long). This bridge was pulled down, and a ferro-concrete bridge erected—one of the first and longest ferro-concrete bridges in England carrying a double line of tramways. In 1906 the Lower Parkstone line was laid and opened for traffic. At the present time the route mileage of the syetem is some 23 and the length of single track over 33 miles, and runs in three boroughs—Poole, Bournemouth, and Christchurch.

The current for the tramways in the Bournemouth area is supplied from the Corporation station. The plant consists of four Lancashire boilers with mechanical stokers, four Belliss and Morcom triple expansion engines, 500 to 600 H.P. each, coupled direct to 4 B.T.H. multipolar dynamos. The condensing plant was supplied by Messrs. Belliss and Morcom. There is sufficient room for the equipment of a further 50 per cent. increase of plant in the station. The whole of the water supply is obtained from an artesian bore 300 ft. deep, and the water is raised by compressed air, steam and electrically driven.

There are four depots and car sheds situated in different parts of the system. The rolling stock consists of 90 cars—45 bogies and 45 single trucks; the equipments are British Westinghouse, British Thomson-Houston; magnetic track and rheostat brakes are installed on all cars.

The maximum gradient is 1 in 12, and the sharpest curve some 40 ft. The gauge is 3 ft. 6 in. right through the system.

The current in the Poole area and the Christchurch section is supplied by the Bournemouth and Poole Electric Supply Company, Limited, owing to prior contracts entered into by the B.E.T. Company, and which the Bournemouth Corporation had to accept when taking over the tramways.

As instancing the growth of tramway traffic, I append particulars of yearly returns from 1903 to date.

Year.	Passengers Carried.	Revenue.	Car Miles.	Total Costs.	Surplus or Deficit.*
		£			
1903 ...	3,073,450	17,637	324,650	8,720	+ 4,826 (S)
1904 ...	9,363,985	52,445	1,002,163	29,810	+ 4,807 (S)
1905 ...	10,058,288	55,276	1,121,623	33,500	+ 7,918 (S)
1906 ...	12,617,927	73,094	1,494,261	44,062	+ 6,416 (S)
1907 ...	13,503,610	83,663	1,765,098	53,598	+ 806 (S)
1908 ...	13,991,328	86,024	1,766,068	53,163	— 385 (D)
1909 ...	13,735,267	82,017	1,748,515	55,680	— 5,416 (D)
1910 ...	14,010,647	85,684	1,794,997	55,901	— 1,755 (D)
1911 ...	14,703,679	89,569	1,784,249	57,717	— 130 (D)
1912 ...	15,121,935	91,421	1,844,507	54,841	+ 3,379 (S)
1913 ...	15,750,576	95,694	1,822,054	52,293	+10,478 (S)
1914 ...	17,182,844	104,353	1,962,352	59,011	+15,070 (S)
1915 ...	16,967,210	101,882	1,815,632	55,066	+ 9,083 (S)
1916 ...	17,577,580	107,575	1,670,702	51,794	+14,057 (S)
1917 ...	17,947,463	113,518	1,634,640	53,711	+16,275 (S)
1918 ...	20,454,597	131,673	1,657,852	62,650	+26,329 (S)
1919 ...	20,769,507	148,272	1,374,411	79,100	+32,000 (S)

* After deduction of interest and sinking fund charges.

* A Paper prepared for the Meeting of the Institution of Municipal and County Engineers at Bournemouth, 9th and 10th May, 1919.

CONFERENCE OF VEHICLE WORKERS.

The annual conference of the Amalgamated Association of Tramway and Vehicle Workers was held at the Law Courts, Cardiff, on May 20. Mr. E. Bawden, of Bradford, presided, and the delegates were formally welcomed to the city by the Deputy Lord Mayor (Councillor W. R. Smith), in the absence of the Lord Mayor. In his presidential address, Mr. Bawden referred to the success of the association in securing a 48-hour week for the employees. As far as the carters were concerned, that really amounted to a revolution, as previously they had been expected to be almost continuously at work. As to future policy, the first thing they would have to do was to see that the war bonus was merged into the ordinary rate of wages. Arrangements had been made for the amalgamation with the London and Provincial Union of Vehicle Workers, and he believed that that course would prove to be one of the best things that had ever been brought about in the interests of the transport industry.

Mr. T. Maclean, of Rochdale, was chosen president for the year.

A long discussion took place as to the legal position of the municipal authorities which had promised to pay half wages to employees who had joined the colours, the authorities having subsequently departed from that undertaking, following the lead of those who had only agreed to make up the pay of the enlisted men to the amount they earned in civil life. A resolution was passed deprecating what had been done, and pledging the Association to take the matter to the Local Government Board, and if necessary to the House of Commons.

A variety of matters were discussed at the concluding session. There was a debate with reference to the formation of the Joint Industrial Council, and the Council approved the proposal of the executive, which was that, for the time being, the executive council should have ten representatives on the workmen's side of the National Industrial Council and that the branches should be allowed to nominate five members. In the discussion on wages it was stated that the executive were not attempting to standardise wages. The policy was to establish a minimum. On the standardisation of wages of tramway workers, Mr. T. Hirst (general secretary) said that the desire was to level up wages. Cardiff and Newport were by no means the lowest paid centres, but were below Birmingham and other large centres, and the aim was to bring them up to the higher level. He warned members that they could not by a strike or any other means obtain all they wanted at one jump.

During an interval, Mr. Arthur Ellis, general manager of Cardiff Corporation Tramways, was welcomed to the conference. He in turn welcomed the delegates to Cardiff, and remarked that the most cordial relations had always existed between himself and the officials of the association. Mr. Hirst, in reply, said that Mr. Ellis had always been in the forefront of tramway managers in the country in recognition of the officials of the association.

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THE NATIONAL ELECTRIC POWER SCHEME.

The long-promised Electricity Supply Bill has at length been brought forward by the Government, and in the House of Commons on May 14 it was, after four hours' debate, read a second time. As is well known, the delay in introducing the measure was largely due to the regretted illness of Sir Albert Stanley, President of the Board of Trade, who had a large share in the preparation of the Bill, and who would have been in charge of it in the House of Commons. His place was taken on May 14 by Mr. Shortt, the Home Secretary.

PROVISIONS OF THE BILL.

The Bill is a long and complex measure, extending to 45 clauses, and a large proportion of it is taken up with the details of the organisation proposed to be constituted. In broad outline the proposals follow closely the recommendations of the report of the Electric Power Supply Committee, over which Sir Arch. Williamson presided. The following is a summary of the main provisions of the Bill.

ELECTRICITY COMMISSIONERS.

For promoting, regulating, and supervising the supply of electricity there will be established a body to be called the Electricity Commissioners, who will act under the directions of the Board of Trade. They will not exceed five in number, and will be appointed by the Board of Trade, who will also determine salaries. That Board will exercise their electricity powers through the Commissioners. The latter may conduct experiments for the improvement of methods of electric supply, and may appoint advisory committees.

DISTRICT ELECTRICITY BOARDS.

The Commissioners may, after holding local inquiries, by special order create districts, and constitute for each district a District Electricity Board. The Boards will include representatives of local authorities, companies, and persons who are authorised undertakers in the district, of large consumers of electricity, and of labour, and where any Councils, not being authorised undertakers, provide financial assistance to the Boards, of representatives of those Councils. The constituting Order may provide for the appointment by the Commissioners of a person experienced in the control of large industrial undertakings as chairman of the District Electricity Board, and for the remuneration out of the revenues of the Board of any of its members.

DUTIES OF BOARDS.

It will be the duty of each District Electricity Board to provide a cheap and abundant supply of electricity, and for that purpose the Board shall have powers as to

(*a*) The acquisition of generating stations.
(*b*) The acquisition of main transmission lines.
(*c*) The supply of electricity (including the construction of generating stations, main transmission lines, and other works).
(*d*) The acquisition of the undertakings or parts of the undertakings of authorised distributors and power companies.

In this work every Board will comply with any directions given by the Commissioners.

ACQUISITION OF GENERATING STATIONS.

From the date of the Order constituting a Board all generating stations within the district, other than private generating stations, and such main transmission lines as may be specified, will vest in the Board, subject to the payment by the Board of the standard price. That price, in the case of station or line belonging to a local authority, will be annuities of such amount as will be required to indemnify the local authority against their liabilities for interest and sinking fund. The price in the case of a station or line belonging to a company or person, will be the sum certified by the Commissioners' auditor to be the cost of construction and the acquisition of site, less depreciation. On a Board acquiring a station they will be under obligation to supply to the authority or company from whom it is transferred electricity not less in amount than could have been generated by the authority or company at a price not greater than that at which it could have been so generated, any dispute to be determined by the Commissioners. When a station or line has been acquired, the Board may agree with the former owner that such owner will work and maintain it on behalf of the Board.

NEW GENERATING STATIONS.

It will not be lawful for any authority, company, or person except a District Electricity Board to establish a new, or extend an existing generating station, without the consent of the Commissioners. Exemptions are provided for private generating stations.

SUPPLY OF ELECTRICITY.

A District Board shall have power to supply electricity within their district subject to two limitations. They are not to supply (*a*) in any area forming part of the area of supply of authorised distributors without their consent, except to lighting authorities, or to railway, tramway, canal, or inland navigation companies or authorities for the purposes of traction; or (*b*) in any part of the area of supply of a power company for any purpose for which the company are authorised to supply, without the consent of the company. The Board of Trade may dispense with the consent if it is unreasonably withheld.

TRANSFER OF UNDERTAKINGS.

Any local authority being authorised distributors may agree with the District Board for the transfer to the Board of the whole or part of the undertaking, payment as in the previous case to be by annuities. The right of local authorities to purchase undertakings is vested in the District Boards. The latter may also acquire the whole or part of the undertaking of any authorised undertakers, not being a local authority, by agreement.

The Commissioners have power by Order to require any authorised undertakers to give specified reasonable facilities for the supply of electricity, and if the undertakers are unable or unwilling to comply, the Board of Trade will have power to order the transfer of the undertaking to the District Board under the terms of Section 2 of the Electric Lighting Act, 1888, or to confer on the District Board power to supply within the area of the undertakers.

In exercising their powers a District Board may lease their undertaking. Provision is also made for compensation for deprivation of employment.

TRANSITORY PROVISIONS.

The Board of Trade may, before the establishment of a District Electricity Board and two years afterwards, construct any generating station, etc., and exercise any powers of the District Board. The Treasury may issue to the Board of Trade any sums not exceeding £20,000,000 for the above purposes or for working capital. The money may be borrowed by Exchequer Bonds. Two years after the establishment of the District Board the works so constructed will vest in them, suitable payment to be made. Between the passing of the Bill and the establishment of the District Boards authorised undertakers may carry out arrangements for mutual assistance.

AMENDMENTS OF ELECTRIC LIGHTING ACTS.

There will be transferred to the Electricity Commissioners the powers of the Local Government Board and other bodies with respect to the sanction of borrowing. Where the consent of the Board of Trade is obtained to the placing of an electric line above ground, the consent of the local authority will not be required. District Boards and authorised undertakers will be entitled to place electric lines below ground across any land and above ground across any land other than building land, in cases where that is otherwise lawful. The prices charged by District Boards will be such that the receipts are sufficient to cover expenditure, including interest and sinking fund, with such margin as the Commissioners allow. The latter may regulate the prices with a view to securing that the benefits of any reduction in cost shall enure to consumers. They may also require any authorised undertakers to alter the type of current, frequency, or pressure employed. Anything which under the Electric Lighting Acts may be effected by a Provisional Order confirmed by Parliament may be effected by a Special Order made by the Commissioners and confirmed by the Board of Trade.

FINANCIAL PROVISIONS.

Every District Board is to establish a fund for receipts and payments, and to submit an annual revenue account and a report to the Commissioners. For the purpose of payment of stations, etc., acquired, where the cost is to be spread over a term of years, a District Board may, under the Commissioners' regulations, borrow money by the issue of stock. Authorised undertakers, local authorities, and companies in the district may subscribe. The Commissioners may lend to a District Board or any authorised undertakers money not exceeding in the aggregate £25,000,000 if the Commissioners are satisfied that the Boards or undertakers cannot otherwise raise the money. This advance is to be issued out of a special fund under the charge of the Commissioners, to be called the Electricity Loans Fund, and raised by the issue of electricity stock. The Commissioners will apportion the amount by which their estimated expenses exceed the estimated receipts among the District Boards, the latter to pay to the Commissioners the sums apportioned. During the first five years, however, the amount

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of the excess will be paid out of moneys provided by Parliament, these advances to be repaid in three years. Money received by the Commissioners will be paid into a separate fund, out of which salaries, etc., will be paid.

GENERAL.

Section 4 of the Conspiracy and Protection of Property Act, 1875 (which relates to breaches of contract by persons employed in the supply of gas or water) is extended to persons employed by District Electricity Boards and by authorised undertakers. The Commissioners may hold inquiries and order the attendance of witnesses. The Board of Trade and the Commissioners may make rules in relation to proceedings before them. Special Orders made by the Commissioners will not have effect unless confirmed by the Board of Trade, and before any Special Order comes into force it must be laid before each House of Parliament for not less than 30 days, and if either House presents an address against the Order, no further proceedings can be taken thereon. There are separate clauses applying the Bill to Scotland and Ireland.

THE MINISTRY OF WAYS AND COMMUNICATIONS.

The following important clause comes almost at the end of the Bill :—In the event of a Ministry of Ways and Communications being established by an Act passed in the present session of Parliament, all the powers and duties of the Board of Trade under this Act, and under the Electric Lighting Acts, and under any Order or Special Act relating to the supply of electricity, shall, as from such date as His Majesty in Council may fix, be transferred to the Minister of Ways and Communications, and accordingly references to the Board of Trade in all such Acts and Orders shall be construed as references to the Minister.

DEBATE IN THE HOUSE OF COMMONS.

The Bill came on for second reading in the House of Commons on May 14. The following is a summary of the discussion that then took place.

Mr. SHORTT, the Home Secretary, in moving that the Bill be read a second time, said that its main object was to reorganise the supply of electricity for industrial purposes. Until the beginning of this century practically the whole of the legislation which dealt with electricity was passed at a time when the real use of electricity was unknown. The Acts of 1882 and 1888 were totally ineffective for the present development of the electrical industry. One result had been that electricity was managed within an area which was substantially the area of the local municipality—small areas, numerous areas, and all of them developed in their own way, and all of them starting their work and their method of production and distribution in their own way. The result was that we were faced with a state of things in which there was a very large number of small electrical concerns, each of them feeding a small area, and an area not chosen because of its peculiar adaptability, or because it was a convenient area necessarily, but chosen solely and simply because of its boundaries for local government. That in itself condemned the existing state of things. There were at present some 600 different electrical works in this country. There were in London alone 70 sets of works and 70 distributing agencies, all of a totally different description, and were not capable of being co-ordinated or of co-operating. In London there were ten different systems of frequency and twenty-one different systems of voltages, and any number of transport systems, and those concerns had three different systems of generating and distributing their electricity. In the case of a breakdown of one, unless it was within reach of another of the same frequency and the same voltage, they could not come to each other's rescue or co-ordinate for the purpose of economy. Altogether, the system was one which was about as bad as could possibly be conceived. The case of railways was somewhat analogous to the present state of electrical production and distribution. Some sixty years ago there were about a thousand railway companies in this country, and it was plain where they had a thousand different railway companies serving a country the size of ours, with their different directors and staffs and other expenses connected with each individual company, that economy and co-ordination were impossible. Add the fact that the gauges of the railways were different, and interworking became impossible. The House would readily appreciate the state of chaos into which the railways of this country might have come, but fortunately the matter was taken in hand and combinations took place, and now there were about 120 companies in this country. We were at present, with regard to electricity, in the same position as the railways once were.

HOW TO GET CHEAP POWER.

It had become very clear, even before the war, what great value electrical power might be. Big consumers all over the country were calling out for cheap and efficient power, and, moreover, for a secure supply of power, because if the great manufacturer with an immense amount of capital was at the mercy of one system, and if in that system there should be a breakdown, then his works would stop. These were things only to be got by co-ordination. If they co-ordinated they got cheapness of supply, a relatively less capital outlay. Each separate concern had to erect considerably more plant than it would actually use, but if they were combined the reserve and spare plant was less, and the capital outlay was relatively less. In addition, if they had the large concentrated plant they were able to generate electricity with a great saving of coal. Over the manufactures of the country it was reckoned that about 7 lb. to 8 lb. of coal were required for each horse-power hour. With a properly erected station, sufficiently large and concentrated, they could deliver the same equivalent amount of power for less than 2 lb. of coal. In addition to that, where they had all the generating stations of an area concentrated into one place they could secure a so much higher load factor. If you have expensive machinery running all the twenty-four hours only up to 25 per cent. of its capacity, it is not being run at the best possible advantage ; but if they could so arrange from the same station to deliver electricity to the trams, the railways, for lighting purposes, for machinery, for heating, cooking, and for every other purpose, they then secured a very much better load factor, and they had the machinery working instead of at about 25 per cent. of its capacity, perhaps on the average up to 75 or 80 per cent. of its capacity. Still more important, they were able to choose the site so much more advantageously if the whole of the generation was collected into one area. It was appreciated of late years much more than formerly the immense importance of having the generating station close to a large supply of water for the purpose of condensation. It was of even more importance that a big generating station should be near a river or a canal than that it should be close to a railway or coalfield, and where they had only to choose, say, a third of the number of generating sites, or even a quarter or a fifth of the number of sites, it was much easier to secure that every generating station should be constructed upon an advantageous site. It became clear, even before the war, what an immense part electrical power might play in the industries of this country and in all the amenities and all the necessities of life as well.

THE SCHEME OF THE BILL.

It was clear that something would have to be done to co-ordinate the system, to create some kind of general policy, and to secure as far as possible greater efficiency and greater economy, and for that purpose three committees were set up. The first was a Sub-committee dealing with the conservation of coal, the second was a Board of Trade Committee dealing with electrical trades, and the third was the Electric Power Supply Committee. These Committees, especially the last, pointed out the conditions governing a cheap and efficient supply of electricity. Having enumerated the chief recommendations of the Committee, Mr. Shortt went on to say that the Bill he was now moving accordingly provided, first that there should be set up a body called the Electricity Commissioners. They would be five in number, and they would be appointed by the Board of Trade. They would for all practical purposes have the conduct of the whole of the policy dealing with the electrical industry in this country. It would be their business to make experiments, to stimulate, to encourage, and to guide, and for that purpose they would have power to set up advisory committees for their assistance. Under them, and subject to their rules and regulations and directions, there would be the local area bodies, and through these local area bodies the Commissioners would have the controlling power over the whole of our electrical policy. They would be subject in many respects to the Board of Trade and, through it, to Parliament. The Commissioners would by means of local inquiries obtain the necessary information to enable them to divide the country into a certain number of areas, and those areas would be chosen and defined by having regard to the questions of generation and distribution of electricity, and also in many cases, where the use of electricity was as yet undeveloped, they would be chosen from the point of view of development and supply when they are developed. For each area there would be set up a Board. Each area would have its own Board, with its own chairman, and its own distinct authority and powers. The Boards would consist of representatives of those who were at present undertakers of electricity industries. Whether they were local authorities or companies, they would be represented upon these Boards. The consumers and labour equally would be represented, and if there was any local authority within the district which chose to subscribe to the expenses of the management of the area, they also would be represented ; and provision was made for the choice of some known and trusted local gentleman of wide business experience for the office of chairman.

FINANCE.

The financial arrangements were first that *primâ facie* each district should find its own finance, and what one might call the supplemental finance would come from the national Exchequer. In the report of the Committee on Electrical Supply, the recommendation was that *primâ facie* the expense should be borne by the national Exchequer, and that any assistance should be upon the local people, but after full consideration, having regard to the general financial position of the country, the Government thought it wiser and better that each district should be responsible for its own finance, that the responsibility for the finance should be in the first place local, and that in the second place the assistance should come from the national Exchequer. That was one of the details in which they had not followed exactly the full recommendation of the Committee. The

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district boards would have power to borrow for the cost of construction of any stations they might erect, for their working capital for the first three years, and for the payment of interest until their works become remunerative. Their duty was to form a fund into which all their receipts would go, and so far as possible their duty would be so to regulate their charges so that their receipts would cover their expenditure, and any margin over and above that would be at the discretion of the Electricity Commissioners. The Commissioners would decide, if there was a margin, what margin the local district boards were to be entitled to keep and what part of the surplus profits was to go for the benefit of the consumers. So long as the receipts were greater than the expenditure, there would be no need of any contribution from the central body at all, but if the receipts were below the expenditure, then the cost would fall upon the central body. There was power for the central authority to advance money to the extent of £25,000,000, and there was further power for the central body to expend something like £20,000,000 during the transitory period while the district boards were being set up. The £20,000,000 would be repaid as and when the boards took over from the central body the work they had done during the transitory period.

TAKING OVER UNDERTAKINGS.

When the district boards were created they would take over within their area every generating station and all the main transmission lines. The intention of the Government had been, as far as possible, not to interfere with the existing undertakings. Local authorities who had their business *clientèle* would be as far as possible left, and all that would be taken over by the District Boards would be the generating stations and those things which were really part of the generating stations, and were not essential to distribution.

What was intended was to leave with the present undertakers the whole of the distribution, and the proposal was that they should by the activities of these District Boards cheapen the production at the generating stations, supply the distributors with what was really for them their raw material, namely, power in bulk, and enable them to supply to the individual consumer at a very much lower price. Therefore all that the Boards would have to purchase were the generating stations and the main transmission lines, and all the plant and machinery necessary merely for distribution, as apart from generation, would remain with the owners. Another provision was that where an undertaker was taking from the District Board in bulk, the Board were bound to supply him at as cheap a cost as he could have supplied himself if he had still been in possession of the generating station. The undertakings would be taken at a standard price, which was fixed. With regard to local authorities, the standard price was annuities, which would cover the necessary amount for sinking fund and interest; and with regard to others, it was the cost of construction and of the site, less anything for depreciation. The intention was that a fair price, having regard to all the circumstances, should be paid.

The Bill attempted, and, he thought, succeeded in carrying out in principle, if not in every minute detail, the recommendations of a Committee which, by its very *personnel*, commanded the respect not only of the House, but of the country, and whose recommendations must have the greatest possible weight. Their recommendations differed in no way from the recommendations of other Committees which had gone into this subject. Transport was essential if we were going to improve the housing in this country. For housing we must have transport. For transport we must have better motive power. Electricity was required for agriculture and every industry, and, indeed, it was only by cheaper, more efficient, and more secure power that we should be able to attain to that amount of production which was essential if we were to keep up wages and conditions of all classes of the community. Motive power was as essential as a cure for low wages as it was as a cure for bad housing.

CRITICISMS.

Sir D. MACLEAN said he hoped that at the Committee stage there would be embodied in the Bill proper safeguards, especially as the Bill would largely do away with Private Bill legislation. They were going to take away from this House, and the purview of its Committees, and transfer to a great central authority, acting in and through District Boards, very important functions. He hoped that these Boards would carry with them the same high sense of public duty, and the same complete freedom from any suggestion of corruption or undue influence, which had been one of the proudest records of Parliament in connection with Private Bill legislation. As far as the general case was concerned, there could be no doubt that it had been thoroughly made out. Lack of co-ordination had resulted in the usual overlapping, inefficiency, and high and unnecessary cost. The Bill set out to remedy that. There was another thing implicit in the Bill—that if the further development in the use of electricity could be thoroughly widespread, especially in crowded urban areas, we should undoubtedly go a long way to solve some of our most pressing health problems. The real difficulty on the Bill would arise in connection with the District Boards. He was afraid that unless the power sought in that direction was mandatory difficulty would arise. The finance was to commence in the local area instead of beginning at the top. With regard to the constitution of the District Boards, the interests of the locality might be subordinated to the trading interest if companies had too much power on the Boards. He hoped there would be adequate safeguards in that direction. It would also be necessary to see that the capital charges were not high.

Mr. GEORGE BALFOUR, who adversely criticised the Bill, referred in particular to the question of cheapening electric power. He cited the cases of a number of factories of different kinds in the country in order to show that their expenses for power were very small compared with the value of the turnover of the factories. Even if the electricity was given free, it would make no substantial difference. In regard to securing abundance of supply, that was entirely dependent on getting further transmission lines and further plants in operation. At the outbreak of the war the electrical enterprises of this country were going ahead rapidly, and if they had had the benefit of five years' development there would have been no question of introducing such a Bill as this. Let the electricity companies and the municipalities draw together, let the Commissioners under the Bill be established, and let it be known that a policy of unification was desirable, and it would be found that unification would come about quickly without having it imposed by District Boards and State regulations. The hon. Member also contended that the principal technical associations and experts of the country were opposed to the setting up of District Boards. He objected to the planting of "D.O.R.A." in perpetuity on the supply of electricity.

AN AUTHORITATIVE VOICE.

Sir A. WILLIAMSON, who was the chairman of the Electric Power Supply Committee, said that the subject had occupied the attention of that Committee for ten months. The proportions given by Mr. G. Balfour between cost for power and value of turn-over were most misleading. In illustration he cited the large consumption of electricity required for electric steel furnaces and for the fixation of atmospheric nitrogen. In regard to general supply, he said that both manufacturers and railway companies were now recognising the great advantage of union in the matter. The hon. Member proceeded to advance general arguments in favour of the use of electric power. In regard to railways, he said that the evidence before his Committee was that electricity was the cheapest motive power for local or suburban traffic, and that it was cheapest for shunting in goods yards. He believed that the electrification of long-distance main lines would gradually follow. There was also the advantage of the increased service possible on city railways instead of incurring the cost of additional tracks. In regard to factories, one of the largest items of cost in a new factory was motive power. If power could be bought much capital would be saved. The hon. Member proceeded to deal with points on which the Bill differed from the recommendations of his Committee. In particular, he mentioned that instead of a mandatory provision, as the Committee recommended, that the country should be divided into districts, the provision in the Bill was that the Commissioners might divide it into districts. If the formation of District Boards was to be optional, there was always the fear that the Commissioners might not set up the Boards in all parts of the country. That was a grave matter, and he hoped in Committee it would be fully considered. It was important that the districts should be large. In regard to profit from working, he said deliberately to the Government that they must be prepared to make a loss to begin with. As to the financial arrangements, his Committee had recommended that the money should be found by the nation, not by the locality. That was the opposite of the scheme of the Bill. He was afraid the Government proposal largely cut at the root of the success of the scheme. There were many drawbacks to putting the burden of finance on the localities. He hoped the Government would reconsider their attitude on some of these points.

Mr. WADDINGTON, while supporting the Bill generally, dissented from the estimates as to the cheapness of electricity, and from holding out a paradise which could not be realised.

MUNICIPAL OBJECTIONS.

Major BARNES moved the rejection of the Bill on the ground that it proposed to take from popularly elected local authorities their powers, and to transfer those powers to Boards created by other methods than that of popular election. He said that he represented the views of the whole of the municipalities, with the possible exception of one on the North-east Coast. He did not oppose the principle of nationalisation, but opposed the proposal that the local administration was not to be of a popular character. What they were getting was national ownership and private control.

Mr. T. THOMSON seconded the amendment.

Mr. SHORTT, replying to the discussion, maintained that democratic control was not absent at all. The District Boards were under the control of the Commissioners, who were under the control of the Board of Trade, which was under the control of Parliament.

After further discussion, a division was challenged on the amendment, but only one teller for the opponents of the Bill, namely, Sir F. Banbury, could be found, and the second reading of the Bill was accordingly agreed to.

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ELECTRICITY SUPPLY BILL.

REPORT OF THE PARLIAMENTARY COMMITTEE OF NEWCASTLE CITY COUNCIL.

Since the Electricity Supply Bill was introduced into the House of Commons, the local authorities on the North-East Coast have agitated for its amendment in several important particulars. Newcastle City Council requested its Parliamentary Committee to consider the Bill, and submit a report on the subject. On May 29 the report was brought before the City Council, and was approved. Subjoined is the whole report :—

1. The Parliamentary Committee have had under consideration the Electricity (Supply) Bill.

2. The Bill, which is largely based upon the recommendations contained in certain reports upon the subject of electricity supply which during 1917 and 1918 were made to the Government, proposes the establishment of a Board of Electricity Commissioners acting under the Board of Trade who are to divide the country into electricity districts, for each of which is to be appointed a District Electricity Board consisting of representatives of (*a*) local authorities, companies, and persons who are already supplying electricity ; (*b*) large consumers of electricity ; (*c*) labour ; and (*d*) Councils (including County, Borough, and District Councils), who are not themselves supplying electricity, but who agree to afford financial assistance to the board.

3. To these boards are to be transferred all existing generating stations and main transmission lines at a price which represents (broadly speaking) for municipalities an indemnity against outstanding charges for sinking fund and interest and for companies the cost of land, buildings, and plant (less depreciation).

4. When established it will be the duty of the board to provide or secure the provision of a cheap and abundant supply of electricity within their districts ; and they may, instead of operating directly, lease their undertakings to existing companies or establish new companies to carry out their duties.

5. The rights of purchase by local authorities of electric lighting undertakings in their areas under the Electric Lighting Acts will be abrogated, and will be transferred to the District Boards.

6. The District Boards' prices are to be sufficient to cover their expenditure on income account (including interest and sinking fund charges), with such margin as the Electricity Commissioners may allow; and the boards are also to supply electricity to any generating station which may be transferred at a price not greater than that at which the former owners could have generated it.

7. On the establishment of the Ministry of Ways and Communications, the powers of the Board of Trade respecting electricity are to be transferred to the Minister of Ways and Communications.

8. The whole question of electric power supply in Northumberland and Durham and the Cleveland area of Yorkshire has been under the consideration of a conference of local authorities since April, 1918, and, prior to the introduction of the Bill, a reasoned statement to which, with two exceptions, the interested authorities were parties, was submitted to the President of the Board of Trade, (Sir A. Stanley) and the Minister of Reconstruction (Dr. Addison) setting out in detail the views of the conference.

9. The Bill, in addition to creating new local electrical authorities separate from and independent of the municipalities and other local authorities, is so drafted that if passed into law in its present form the District Board for this area might well be so constituted that the interests of existing electrical undertakings operated for individual profit would have an undue ascendancy, and the influence and control of representatives of the municipalities and other local authorities be negligible and ineffective. In this way the principle of local public control of electricity supply would be obviated, and the virtual monopolies of the electric power companies who have in the past been able to extend their activities in districts from which the municipalities have been debarred would be consolidated and strengthened.

10. Without dealing in detail with the provisions of the Bill, the Committee recommend the adoption by the Council of resolutions in following terms :—

(1) That the necessary measure of local public control upon the District Electricity Boards can only be secured, and public confidence in such Boards be engendered and maintained, either by the complete elimination from such boards of representatives of commercially-owned electrical enterprises, or, alternatively, by provision being included in the Bill securing that the number of representatives of local authorities upon any District Board shall be such as to give such representatives a clear majority of the whole number of the board.

(2) That the " standard price " proposed for generating stations of local authorities transferred to District Boards will operate unfairly as between local authorities and companies, and is also inequitable and unjust, being to the detriment of those local authorities who have carried on their undertakings with economy and prescience as against those whose undertakings have been improvidently conducted ; and that the terms of transfer should be the same both as regards company-owned undertakings and those of local authorities, viz., the cost of land, buildings, and plant, less depreciation.

(3) That the provisions of the Bill which enable District Boards to operate through companies who are authorised undertakers and through companies specially constituted for the purpose, and also to lease their undertakings to companies, are open to strong objection as being contrary to the principles upon which a national supply of a commodity of public utility should proceed, and as tending to consolidate and strengthen the monopolies of electricity undertakings operated for private profit.

(4) That express provision should be inserted in the Bill enunciating the principle that District Electricity Boards shall supply electricity at the actual cost of generation and transmission together with a margin for contingencies to be fixed by the Board of Trade ; and that as regards the supply of electricity to the owners of a generating station or main transmission line transferred to the board the cost at which the owner could have generated it or the cost to the board, whichever be the smaller, shall be the price to such owners.

(5) That it be obligatory upon District Electricity Boards to publish annual reports, statements, and accounts in a form to be prescribed from time to time by the Board of Trade containing such particulars as may disclose a full, fair, and accurate statement of affairs, including scales of charges and particulars of special contracts entered into, such accounts and particulars to be delivered to the Clerks of Local Authorities in the boards' areas, and to be obtainable for a current year or for any year during the preceding five years by individuals on payment of a nominal fee.

(6) That the Committee be authorised to take all such steps as they may deem necessary to give publicity to the views of the Council, and to bring them to the notice of Members of the Houses of Parliament.

Dated this 27th day of May, 1919. GEORGE LUNN, Chairman.

THE TECHNICAL INSPECTION ASSOCIATION.

Owing to war demands the number of the military staff at the Woolwich Inspection Department became quite inadequate, so the services of civilians had to be called upon. These came from all parts of the world, and were chosen for their engineering, scientific, and technical knowledge. The total number of men so employed grew to 1,500, and formed a corps of zealous specialists. Some educated women also came forward to assist. At the end of the war a scheme was started to enable the members of the department to keep touch with one another after their dispersal, and to continue an organisation for that purpose by adding to their number.

A provisional committee was formed in January, 1919, after a meeting held in London on December 19, 1918. At a subsequent meeting in March the present Council was elected, and the inaugural meeting of the Technical Inspection Association was held in two of the minor halls of the Wesleyan Central Building on the evening of May 9, 1919. The president, Mr. A. H. Collins, C.B.E., M.Inst.C.E., was in the chair, supported by the vice, Mr. A. E. Hedley, C.B.E., and several members of Council. One of these, Lieut.-General Sir Percy Lake, K.C.B., K.C.M.G., and the hon. secretary, Mr. W. Haynes Smith, devoted much time and trouble to the preparation, the result being a most successful evening.

The president, after serving on the Great Northern, Great Central, Buenos Aires Great Southern, and as chief engineer on the Shanghai-Hankin railways, was appointed Controller of the Government Inspection Department. In his address on this occasion he made full use of his technical knowledge and experience, and deeply impressed on his hearers the advantage, indeed, the necessity, of close inspection by technical experts in all manufactures both in peace and in war time ; especially so as regards chemical research, without which the mechanical tests, however carefully done, would be of comparatively slight value.

Mr. Collins struck what we think is a new note when he pointed out that a thoroughly experienced inspection officer could, by bringing his knowledge to bear at the design stage, assist in the competitive race for commerce with which our factories are now faced. This he would do by ensuring simplicity, and therefore ease of inspection in any manufactured article. The president is convinced that the members of the association will become recognised as specialists whose work and judgment would be accepted without question, and that in the development, progress, and success of British industry the efforts of the members will become a material if not an indispensable factor.

Cinematograph views were given at intervals of inspection work ; refreshments were served in the adjoining hall to the strains of the excellent string band of the Royal Horse Artillery, and the aisles of the lecture hall were lined with exhibits of the results of inspection or of the tools and appliances used in the work. A large proportion of the 500 members enrolled, with a number of their friends, were present, including many ladies, and everyone thoroughly enjoyed themselves. The present address of the association is Hotel Metropole, Northumberland Avenue, S.W.1.

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MINISTRY OF WAYS AND COMMUNICATIONS BILL.

PROCEEDINGS IN STANDING COMMITTEE FROM MAY 6 TO MAY 28.

At the resumed sittings of the Standing Committee on the Ministry of Ways and Communications Bill, on Tuesday, May 6, Clause 3 (power to control temporarily railways, etc.), with amendments, was recapitulated. As it then stood, Clause 3 provided that (1) the following provisions shall have effect for two years after the passing of the Act: (*a*) the powers hitherto exercised by the Board of Trade over transport undertakings shall be transferred to the Minister; (*b*) the Minister may take possession of railways, light railways, tramways, canals, docks, etc.; (*c*) the directors and plant of transferred undertakings shall be wholly under the control of the Minister, and shall obey him as to (i.) rates and fares to be charged, (ii.) salaries and wages to be paid, (iii.) working and discontinuance of the undertaking, (iv.) design and equipment of plant and appliances, (v.) alterations and improvements, (vi.) co-operation between undertakings, (vii.) facilities for exchange of running powers, (viii.) manufacturing and repairing facilities, and (ix.) preparation of accounts, statistics, returns, etc.; (*d*) the Minister may authorise acquisition of lands, construction of works; (*e*) any fares, rates, etc., directed by the Minister may be charged, notwithstanding statutory limitations. (2) There shall be transferred to the Minister any officer or servant of an undertaking of which possession is taken, but no officer or servant shall be in any worse position as regards salary, etc., than he would have been had his services not been transferred. (3) Section 20 of the Local Government (Emergency Provisions) Act, 1916, which relates to the establishment of new routes for omnibuses, shall continue in force until the expiration of two years after the passing of this Act. (4) Where by reason of the exercise of the powers under this section, the value of any undertaking has been depreciated or enhanced, the owners of the undertaking shall be entitled to be recouped or liable to pay the amount by which the value has been depreciated or enhanced. (5) The provisions of the Railway and Canal Traffic Act, 1888, as amended by subsequent enactment, shall apply to the determination of questions arising under the Act.

The Committee agreed, without discussion, to an addition to Clause 3, proposed by Sir Eric Geddes, setting up an advisory committee to assist the Minister of Transport in giving directions as to rates and charges.

Mr. Joynson-Hicks moved an amendment to Section 3, the effect of which is to provide that the existing powers of highway authorities in regard to omnibuses shall remain unimpaired, but that "where upon application for a licence to ply for hire with an omnibus the licensing authority either refuses to grant a licence or grants a licence subject to conditions, in either case the applicant shall have a right of appeal to the Minister from the decision of the licensing authority, and the Minister shall have power to make such order thereon as he may think fit, and such order shall be binding on the licensing authority."

This important amendment was discussed at length, and its application was defined by Col. Sir Rhys Williams as follows:—"The highway authority will still have the same power of objecting to omnibuses running on routes as they have now under the emergency powers, but the appeal which the omnibus companies have at present against the refusal by the highway authority they will still have, only that appeal will come to the Ministry of Ways and Communications instead of to the Local Government Board. To meet a conceivable position—where a local authority has refused to allow an omnibus company to run on a certain route, and that company has appealed to the Minister of Ways and Communications successfully, it is possible for the highway authority then to put such conditions—if it is the licensing authority for vehicles—on the licence that the company could not run them. As the law stands at present, the omnibus company has no appeal against any conditions which they may think arbitrary or unfair. This amendment gives them an appeal against any conditions which they think are arbitrary on the licensing of vehicles, so that the omnibus companies will be in a better position after this." The amendment was agreed to.

An addition to Clause 3 was moved by Mr. Shortt, safeguarding the right of local authorities to purchase tramways or light railways used as tramways. The amendment was accepted.

Sir William Raeburn moved an amendment requiring that the Minister take over the whole of any harbour or dock undertaking, part of which he desired to acquire. The Home Secretary, Mr. Shortt, replied that the Government could not entertain such a proposal, and the amendment was rejected.

Clause 4 (power to acquire railways and other undertakings) was, on the motion of the Home Secretary, eliminated from the Bill.

Clause 5 (power to make advances for certain purposes).—(1) The Minister may, subject to the approval of the Treasury, make advances out of moneys provided by Parliament, to any authority, company, or person, either by way of grant or loan, for the purpose of constructing railways, tramways, roads, bridges, ferries, harbours, etc., and maintenances of these. Sir Frederick Banbury proposed an amendment to prevent public aids being used for the purpose of competing against companies. Sir Eric Geddes pointed to the fact that, under another section of the Bill, companies or undertakings would have the option of taking up any service in which they were engaged before the Minister took steps to establish it. On this understanding the amendment was withdrawn. Upon this clause also Mr. Joynson-Hicks drew from the Government the admission that all roads would be classified under the superintendence of General Maybury. Clause 5, as amended, was ordered to stand as part of the Bill.

Afterwards Clause 6 (power to require statistics and returns) came under discussion. A proposal was made to exclude owners of private streets and roads from the undertakings called upon to furnish such accounts and statistics as the Minister might require. The amendment was rejected, and the Committee adjourned.

At the next sitting on Wednesday, May 7, Clause 6 was amended by the addition of the words "provided that the Minister shall be liable to repay to such owners any extra cost involved in the preparation of such accounts, statistics, and returns." But the opposition to the clause seemed likely to be prolonged, and the Home Secretary asked leave to withdraw it, undertaking to produce a new clause on report. On this understanding the clause was withdrawn.

Clause 7 (power to hold inquiries) provides that the Minister may hold such inquiries as he considers necessary for the purposes of the Act. With a small technical amendment, the clause was passed.

Clause 8 (staff and remuneration) deals with the appointment and remuneration of the staff required by the Ministry. Reference having been made to the possibilities of jobbery in such a service, the Government undertook to consider the question whether it would be possible to arrange that appointments should be made by an authority independent of political pressure.

On Clause 9 (seal, style, and acts of Minister) two small amendments were made. The first was insertion of a paragraph making the Minister responsible for the acts and defaults of his officers and servants, and "liable to pay costs in like manner as a private person." The second amendment was designed to enable the Minister to acquire and hold lands in trust.

The rule that Ministers, on accepting an office of profit, should stand for re-election, was obviously not intended to apply to members of Government appointed for their technical qualifications rather than party opinions. By Clause 10 (ability of Ministers and secretaries to sit in Parliament) the rule is abrogated, Section 2 providing that the Minister first appointed shall not vacate his seat in Parliament for that reason. Sir F. Banbury moved that the section be deleted, but the Committee almost unanimously agreed to the whole clause.

In the definition of the Bill by Clause 11 (short title and interpretation), and sub-sections, Sir Eric Geddes proposed an amendment which would include a "trackless trolley system" and "any service ancillary to the principal business of the undertaking," so that the powers taken might be complete. The amendment was accepted.

On Tuesday, May 13, a crucial issue was raised. A new clause relating to the provisions of the Railway and Canal Traffic Act, which, as Sir Eric Geddes said, was only machinery, was accepted by the Committee. It was upon the new clause defining the constitution and powers of the advisory committees which it was proposed to set up that the contest between the Government and the determined critics of the Bill was waged. It must be said that the framing of the clause was provocative, and its terms amounted to a challenge inviting the opposition to do their worst. The clause gives the Minister powers to appoint advisory committees, but neither imposes upon him the duty of appointing nor the obligation to accept the advices of such committees. Mr. Joynson-Hicks took up the challenge, and moved an amendment providing that an independent Committee, consisting of nine persons, be appointed, and that before exercising certain powers of directing the establishment of transport services, the Minister shall refer the matter to the Committee for their advice, and they shall report thereon to him. Concluding his speech in support of the amendment, Mr. Joynson-Hicks said:—"I suggest that we should be failing in our duty if we did not try to establish some committee of this sort, not to control the right hon. gentleman, but at least to make sure before he does one of these acts, which cannot be undone once done, that he should at least go before a committee and convince them that he is right, and if he does not convince them, if they make an unanimous report that his proposal was an improper one, then my right hon. friend might drop it, and say that he would not think of attempting to carry it out." Replying on behalf of the Government, Mr. Shortt pointed out that the proposed amendment would destroy the Bill. He contended that the compensation clauses amply protected any interests which might be affected, and that as the effect of the clause giving the Minister power to take possession of undertakings was limited to two years, the checks upon his action were sufficient. "Therefore," he argued, "I ask the Committee to say this amendment is totally unnecessary. It is contrary to the general principle and the whole basis of the Bill, therefore we cannot accept it. With regard

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to the advisory committees which my right hon. friend proposes, supposing it were a labour question which was raised, he could ask trade unions to give him a committee consisting entirely of trade unionists. If it were a question of docks, he could get a committee consisting entirely of dock people. If it is a general matter affecting railways, roads and docks jointly, he could have a joint committee. He can have a committee exactly as he wants it, and that committee can give him all the advice that is necessary. I am sure that my hon. friends who have moved and seconded the amendment do not wish this Committee to treat the Minister as if he were some great malevolent influence out for the purpose of ruining the country. Therefore as compensation is provided, and it is admitted that the Minister is out to do the best he can for the country, and that you have a proper provision for compensation to any undertaking that is taken over if any harm is done to it, the need for these checks and safeguards is entirely gone, and I ask the Committee to reject the amendment."

At the end of a long day's discussion, the Committee rejected first the amendment of Mr. Joynson-Hicks, and then the new clause proposed by Sir Eric Geddes. In this position the Committee adjourned.

On Wednesday, May 14, after deciding to adjourn at 1 p.m., to allow members to attend the second reading of the Electricity Supply Bill, in the House of Commons, the Committee gave consideration to a new clause on advisory committees, submitted by Sir Eric Geddes, and an amendment proposed by Mr. Neville Chamberlain. Both proposals were rejected, and a rather difficult situation was created thereby. In order that the matter might be settled, the Government was requested to submit another clause, and Mr. Shortt moved that (1) a panel be set up, consisting of experts representing the various classes of undertakings affected, as also labour, trading interests, local authorities, and such other interests as the Minister shall deem desirable; and (2) to require the Minister to refer to a committee selected from this panel any questions which he may consider of sufficient importance affecting the establishment of new transport service by land or water. The clause was accepted.

Amendments to the new clause setting up a panel from which advisory committees would be selected were proposed and debated on Thursday, May 15, the chief effect being to remove from the Minister the option of referring any matter to an advisory committee, and to give power to the undertakings and interests affected the right to object and appeal.

An important new clause was brought forward on Tuesday, May 20, by Sir Eric Geddes, making provisions relating to officers or servants of any undertaking, of which possession may be taken or retained under the Act. For the purposes of this clause, the Lord Chancellor shall appoint a standing arbitrator or board of arbitrators, who shall consider questions as to whether any officer or servant has suffered injury or loss by any change made by the Minister, and award such sum as they deem sufficient to compensate for the loss or injury. Amendments to the clause were moved, but the clause was passed substantially as proposed by the Minister.

Discussion on Wednesday, May 21, centred largely on subsidiary questions and matters of detail. Proposals to make special provisions in regard to the Port of London, and to invest the actual management of undertakings controlled by the Ministry in a Board of Commissioners, six in number, three to be representative of labour, were rejected. Mr. J. D. Gilbert moved a new clause as follows :—" The Minister shall have the power to grant permission for through runnings on adjoining tramways belonging to different owners, whether local authorities or not, and in default of agreement between such owners to settle the terms of such through running, after hearing the said owners, in such manner as he thinks fit." Sir Eric Geddes accepted the amendment, substituting the word " require " for " grant permission," so that, as he said, he might have some power of initiation. The clause was agreed to.

The Home Secretary, on Thursday, May 22, moved the second reading of a proposed new clause designed to deal with claims made against and by the Minister of Transport in respect of the exercise of his powers under the Act. In introducing the new clause, Mr. Shortt said :—" This is a clause which is intended to secure that there should be absolute fairness of dealing between the Ministry and any undertaking which is affected by the exercise of his powers by the Minister under the Act. . . . The clause not only provides for the payment of compensation to an undertaking which is depreciated, but it also provides for the payment by an undertaking of enhancement of the value. If the Ministry expends money upon an undertaking, and it results in the enhanced value of that undertaking, then the undertaking will be liable to pay the Ministry the equivalent of compensation if there had been, instead of enhancement, depreciation in value. It is proposed that the value shall be based upon the revenue-earning basis." Two provisos were attached to the clause. The first provided that " no claim in respect of any loss alleged to be due to any direction issued by the Minister shall be entertained, if the direction was issued with the concurrence of the owners of the undertaking." By the second proviso it is agreed that " if the Minister has done something which has enhanced the value of the undertaking, and the undertaking is about to be purchased by the State and valued by the tribunal, they are not as of right to claim the value of the improvements carried out by the Minister." On the motion of Mr. Neal, the Committee inserted in the clause words providing that, in ascertaining reduction or enhancement of value, the tribunal should take into account " the natural growth of traffic on any railway belonging to a company which, prior to possession being so taken, had not paid a dividend of 4 per cent. on its ordinary capital." As amended, the clause was added to the Bill.

Strong opposition was offered by members of the Committee on Tuesday, May 27, to the new clause relating to the provision of powers for the purchase of privately-owned wagons. Mr. Shortt said the clause provided that the Minister might purchase privately-owned wagons for use on the railways, and in order that no individual trader might be prejudiced in relation to other traders, if any wagons were taken all must be taken. Provision was also made for the fixing of charges for the use of wagons, and for dealing with demurrage. The clause was absolutely essential for the purpose of pooling rolling stock. Severe criticisms were made upon the clause by members of the Committee. Replying to objections raised, Mr. Shortt pointed to the fact that, during the war, the pooling of wagons had resulted in a saving of nearly £3,000,000 per annum in shunting alone. The total saving by pooling had amounted to something like 34 per cent. On the chairman intimating that he could not take another clause dealing with the same subject, the clause was agreed to.

At the final sitting of the Committee, on Wednesday, May 28, several amendments to the wagons-purchase clause were proposed. Mr. Nelson sought to protect the interests of wagon repairers, and moved that words be inserted providing that, when wagons were purchased by the Minister, any contracts for repairing those wagons should be adjusted by agreement. Mr. Shortt undertook, before the report stage, to draft a form of words which might meet the case.

A new clause giving power to discharge capital liabilities under the Act by the issue of stock, and providing that the Treasury may create and issue securities for that purpose, was agreed to, with minor modifications to be embodied in another draft of the whole clause.

Sir William Raeburn moved the addition of a new clause, providing that in the event of an authority or person claiming that any direction of the Minister was unreasonable, appeal may be made to the Railway and Canal Commission, who may cancel the direction. Mr. Shortt opposed the clause, and it was negatived. Thanks to the Chairman of the Committee, Mr. William Brace, concluded the proceedings.

The measure will come up for third reading in the House of Commons after the Whitsuntide recess.

CONTRACT FARES AT BLACKPOOL.

Seldom has the raising of tramway fares caused such a ferment among the people affected as the proposed increase in the charge for contract tickets made by Blackpool Corporation. Curiously enough, there are few increases in tramway fares more evidently justifiable, so far as an outsider can judge. It appears that, early in the history of Blackpool Corporation Tramways, a system of yearly contract tickets was instituted, whereby anyone might travel over any part of the tramways system for the sum of £3 per annum. The measure was well-advised, for, on the one hand, it encouraged people to make their homes near the tramway line outside the town, and on the other hand the tramway system was small and in need of traffic. Now, however, the mileage of the Blackpool tramways is vastly increased, the cars are congested, and passengers who pay ordinary fares are charged out of all proportion to the amount paid by the holders of contract tickets. Anyone buying a contract ticket can travel for, say, about twopence a day, distances which cost ordinary passengers at least three times as much. Some alteration in that state of matters has long been overdue. It may be that the raising of the price of the contract ticket from £3 to £8 is just a little too sudden, and the outcry of the contract ticket holders is quite natural. Meetings have been held by the ticket holders and their friends, protesting against what they regard as an outrage. To obviate grievance, Blackpool Corporation Tramways Committee instructed Mr. Furness, the general manager of the tramways, to draw up a scheme for contract tickets. The scheme, which provides for contract tickets graded from £4 to £8 per annum for adults and £2 10s. for juveniles, according to distance, has been approved by the committee.

Track Repair Required at Salford.—At a meeting of Salford Town Council, Alderman Linsley, chairman of the Tramways Committee, alluding to the contribution from the tramways of £25,000 toward the rates, said that 30 miles of their 60 miles of track were in a very bad condition, and if the Corporation insisted on taking any large sum from the Tramways Committee fund, the committee would have no alternative but to ask for a contribution from the rates for repairs.

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TRAINING OF MOTORMEN, CONDUCTORS AND INSPECTORS.*

By M. Karl Rothy,
Chief Inspector of the Budapest Tramways.

All tramway undertakings are bound to give careful attention to the selection and training of their motormen, conductors, and inspectors. It is a matter of the first importance that every such service should have at its disposal a thoroughly trained and disciplined staff to which its rolling stock may be entrusted without fear of accidents or uneconomical working. A motorman who has undergone a satisfactory course of instruction in all branches of his duty, and who pays attention to all rules drawn up for the furtherance of public safety, can not only avoid many accidents, collisions, and interruptions of the service, but can also drive his vehicle in such a way as to minimise wear and current consumption, two very important factors in the costs of the undertaking. Moreover, by due observance of the timetable and his position with regard to other cars, he will materially increase the regularity of service. A trained conductor is able to assist the financial side of the undertaking even more directly by ensuring that all passengers pay the correct fare. He has also to secure within his own sphere the observance of all regulations relating to public safety, good order, hygiene, etc.; in this connection he must be both tactful and firm, so as to obtain compliance with the regulations without giving offence to passengers.

In spite of the fundamental importance of a thorough training of the *personnel*, there is another part of the question to be considered. It cannot be said that all the difficulties occurring in the course of the service are by any means due to ignorance, though many outsiders, and sometimes even persons connected with management, would lead one to believe that the one universal trouble was lack of sufficient training. The real cause will often be found to lie in the non-compliance by the *personnel* with regulations of which they are perfectly well aware. It is this which brings us to the necessity of establishing a permanent system of control, and requires the selection and efficient training of an inspecting staff.

We will consider the instruction given to car crews on various undertakings from whom replies have been received. The total number, one hundred, was purely due to chance, but is of convenience in drawing percentages. I must point out, however, that this does not help much, since that number includes a great variety of systems under very different working conditions. For instance, a motorman on a small system will clearly not need the same time to learn the manipulation of one standard type of car as a *confrère* who may be called upon to handle a number of different cars. Again, the existence of overhead cables or conduits, unguarded junctions or lamp signalling, all have their say in the period required. Similarly a conductor on a small system with a simple tariff scheme will learn his duty much more rapidly than his counterpart in a city where considerable knowledge of routes, transfers, etc., may have to be acquired. Yet another factor is the class of man available; where the average run of recruits are of a higher standard of intelligence the course can be made correspondingly shorter. The relative periods required for drivers and conductors on various undertakings are as follows:—

Motormen.			Conductors.		
On 5 systems	...	Up to 8 days.	On 8 systems	...	From 3 to 5 days.
On 5 ,,	...	From 5 to 10 days.	On 19 ,,	...	,, 5 to 8 ,,
On 24 ,,	...	,, 10 to 15 ,,	On 14 ,,	...	,, 8 to 10 ,,
On 22 ,,	...	,, 2 to 3 weeks.	On 19 ,,	...	,, 10 to 15 ,,
On 17 ,,	...	,, 3 to 4 ,,	On 17 ,,	...	,, 2 to 3 weeks.
On 8 ,,	...	,, 4 to 5 ,,	On 10 ,,	...	,, 3 to 4 ,,
On 6 ,,	...	,, 5 to 6 ,,	On 7 ,,	...	More than 4 ,,
On 12 ,,	...	More than 6 ,,	On 2 ,,	...	Undeterminate.
On 1 system	...	Undeterminate.	On four systems there are no conductors employed.		

Thirteen undertakings require their *personnel* to go through courses of instruction in both branches of the service, and it is clear that in such cases the necessary period will be at least as long as that required for the simple motorman's course, and probably longer. In thirteen cases motormen are only selected from among the existing conductors, while in fifteen every conductor is required in the first place to perform the duties of motorman for a given period. In those cases where instruction is given in both branches the man is employed in either capacity. There can be no doubt that great advantages attach to this system, but on many of the larger tramways, where complete instruction for all would prove too costly, only that proportion of the staff are given the dual training which will provide a reserve sufficient to compensate for fluctuation in the strength of the two branches, and enable measures to be taken to deal with particularly heavy traffic on special occasions.

At Mannheim and Neuchatel the classes are held in the evening, and in the latter case the company allows the men to continue their former occupation during the day time.

Much necessarily depends upon the use to which these instructional periods are put. If the pupils are continually under the instructor's eye and individual attention is given, it is clear that much more rapid progress will be made than by constant reiteration of formulæ or by merely putting into the beginner's hands a collection of rules and regulations which he is expected to learn first, and then endeavour to understand. From another point of view, more rapid acquisition is often obtained by making it the pupil's interest to become efficient as quickly as possible by study and attention; moreover, such an arrangement has the additional advantage that in the event of failure the institution is not required to defray the entire cost.

In arranging schemes it is necessary to consider, on the one hand, whether wages should be paid during instruction, and on the other what method should be adopted for deterring employees who may wish to leave the service of the undertaking so soon as they have profited by the course, or even before its conclusion. The simplest method is in vogue on the tramways of Aix-la-Chapelle, Algiers, Astrakan, Basle, Bordeaux, Breslau, Brussels, Cairo, Elberfeld, Fribourg, Geneva, Ghent, Le Havre, Christiania, Liège (2), London, Lyons, Madrid, Magdeburg, Mannheim, Marseilles, Neuchatel, Neustadt, and Paris. In these cases no wages are paid until the men are proficient. By other authorities learners are paid a reduced wage during training, and these include Amsterdam, Barmen, Berlin, Budapest, Crefeld, Crernowitz, Darmstadt, Dortmund, Dresden, Genoa, Gerthe, The Hague, Heidelberg, Linz, London, Lucerne, Munich, Nuremberg, Paris, Kattowitz, Hamburg, Tientsin, Bonn, Hagen, and Petrograd. At Christiania, Erfurt, and Mulheim certain reductions are made from wages, while Dusseldorf, Lubeck, Mansfield, Saint-Gall, and Schlieren only commence payment after a certain stage in the course has been reached. In all other cases full salary is paid to pupils.

In view of the high costs of training, in which wages, wear of uniform, administrative expenses, provision of learner's apparatus, practice vehicles, etc., must all be included, it is of great importance that only those who can be relied on to render useful service at the end of the course should be admitted. This aim, however, is not easily realised, and certain undertakings have been obliged to take measures to prevent men whom they have wholly or partially trained from abandoning their service until they have made some effective return. The arrangement of twenty-four undertakings are as follows:—Bremen, Darmstadt, Hagen and Rostock, Mulhaus, and Saint-Gall all require a minimum period of service of three weeks; Dresden, four weeks; Chemnitz, six weeks; Brandenburg, Budapest, Dortmund, Kattowitz, Limmathal-Schlieren, Strassburg, six months; Mannheim, seven months; Dortmund (electric), nine months; Berlin, Crefeld, Düsseldorf, Leipzig, Christiania, and Waldenburg, twelve months; Budapest (electric), thirteen months. In these cases, if an employee should desire to leave before the expiration of his engagement period, or should be dismissed the service for some serious misdemeanour, he is liable to forfeit in whole or in part the money which was paid to him during his learner's period. On a few of these systems it is customary to withhold a portion of such wages until the completion of the obligatory period. All these arrangements, it will be observed, are really exceptions to the general practice, but they achieve their object of excluding from the instructional classes all except those who intend to take up the work seriously.

From the various replies that have been received, it appears that almost all undertakings conform to certain general principles in the course of instruction, though as we have already indicated the details and the length of time required necessarily vary with the size of the system, and the diversity of its technical appliances. In the larger undertakings, where there are always a certain number of men under instruction, definite classes are formed, and a regular timetable drawn up. The learner motorman is first taken to the car depot, where he is shown the equipment of the cars, the use of the controller, of the electric conductors, of the brakes, etc. After the first demonstration he is required to practise all the movements on a car without current. From the first the importance of starting gradually is insisted upon, and the pupil is taught to remember the correct time interval for each notch (two seconds) by counting aloud two numbers such as 21-22 with several syllables. After that he is taken out on special learners' cars, or possibly ordinary cars that are not in use, and allowed trials under the immediate supervision of the instructor. Needless to say this takes place where possible on an unused section, so that as progress is made minor defects or stoppages can be brought about to give the pupil instruction in the methods of dealing with them. Theoretical instruction is carried on jointly with the practical, so that the learner is taught the rules of the road, regulations for the use of signals, and the rendering of reports, as well as the rights of priority in passing and in the use of single line sections. Both in theory and in practice the question of safety receives the most careful attention, and all means for preventing accidents and collisions are thoroughly dealt with, special measures being taken to test the coolness and presence of mind of the pupil. An interesting detail is the method employed by M. Zsarko, chief inspector in charge of instruction, who arranges to have life-sized dummies thrown in front of cars moving at high speed. This gives the pupil an opportunity to display his quickness, while impressing upon him the necessity of being always on the look-out, and prepared to stop

* A Paper prepared for the International Tramways Congress, 1914, and recently issued by the Permanent International Tramways Union.

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the car in the shortest possible time. To give the candidate practice in halting at the exact spot desired, white discs are unexpectedly put up at different points on the route, and on perceiving these the pupil must stop the car immediately in front of them. These devices for safety instruction have been in use on our system for over two years, and have undoubtedly resulted in better and more careful driving.

At the same time pupils will be taught the great importance of driving the car in as economical a manner as possible, not only as regards current consumption, but also from the point of view of reducing wear in controller, brakes, etc. As far as possible clear explanations are given and devices employed for demonstrating and impressing this important matter on the pupils' minds. Fifty-five systems use some form of meter to show how much current is being consumed, while the remainder are content with explanation. At any rate, it is evident that the use of meters, if only on the instructional cars, is desirable.

The question of offering bonuses to economical drivers does not fall strictly within the subject of this paper, but it is so closely connected with the completion of their training and with the inspecting department that it cannot be altogether omitted. It has already been the subject of numerous papers, and it is unlikely that universal agreement will be found for some time to come. The plan has been adopted upon the 21 lines mentioned here :—Algiers, Bordeaux, Budapest (2), The Hague, Hamburg, Linz, Liége, Madrid, Magdeburg, Marseilles, Moscow, Mulhouse, Paris (3), Rostock, Vienna (2), Wurzburg. At Stockholm and Warsaw the authorities publish at regular intervals the names of those motormen who have shown satisfactory results, as a means of encouraging all to greater effort. There are two distinct principles upon which the award of bonuses has been based. In some cases the economy is reckoned solely from the readings given by meters on the cars, while the remainder take into account general good service, observance of traffic regulations, avoiding of accidents, and the maintenance of good order and discipline.

Exactly similar principles are applicable to the instruction of pupil-conductors. The theoretical portion of their course includes traffic regulations, the geography of the routes, correct handling of the tickets, demeanour towards passengers, and the method of keeping count of fares. The practical portion of their course usally takes place on working cars under a trained, capable, and trustworthy conductor. On the technical side those who are being trained as conductors only will have to learn nothing but the most essential operations, such as opening the emergency switch and applying the brakes (in case anything should make it impossible for the motorman to stop the car), making fast or releasing a trailer, removing a damaged trolley, working the points, etc. On joining the Budapest tramways, a prospective conductor is given a schedule of the seventeen days' course he is to undergo, and this is found of considerable assistance to both pupil and instructor. I do not hesitate to recommend the system to any large undertaking which may not have adopted it as yet. The last paragraph requires the pupil to draw up a daily report during his instruction showing what he has done ; this is to be initialled by his instructor. The report provides an excellent means of judging the general intelligence and degree of education of the student when the examination comes round.

Where classes are large, examination dates are fixed beforehand, and these are only held on the conclusion of each course. On smaller undertakings it is often possible to recognise superior ability, and vary the period of instruction accordingly ; in such cases the time of examination is adjusted as desired. The final examination, which is not related to any preliminary tests that the instructors may have given their own pupils, is arranged by some higher official of the undertaking (director, chief engineer, chief inspector, etc.), who is responsible not only to his administration, but also to the public authorities. A representative of such authorities attends all final examinations, the status of the individual being defined in the following cases :—Hamburg, police official ; Marseilles, Tramways Inspection Board ; Munich, a member of the " Revisionverein " ; Nuremberg, Paris, and Stockholm, police officials ; Strassburg, Mining Board ; Petrograd, Government railway official. In addition to these the examinations at Berlin are liable to be visited without notice by a railway official, those at Budapest by the Railways and Waterways Inspecting Board. Fifty-three of the undertakings give their conductors driving permits on passing the examination, while the remainder are content to enter the fact in a special file or in the men's individual records. The majority allow the drivers to start regular work so soon as they have passed the test, confining them as far as possible to quiet routes at first ; fourteen give them a further week on a car in charge of an experienced driver. The conductors start duty on their own at once, but are carefully watched by inspectors for the first few days.

The training of inspectors is a simpler matter, for in nearly every case they are chosen from the ranks of the existing *personnel*. Tried men of considerable experience, normally something over ten years, are selected if they show the requisite intelligence and tact, and are thoroughly acquainted with conditions in both branches of the service. This latter qualification is practically beyond the reach of an outsider, and so he is altogether excluded from the ranks of uniformed inspectors. A few days' training is usually sufficient for those who have served their time in the other branches. This system has the advantage of holding out an opportunity to the employees of improving their position by loyal and zealous service ; on the other hand, it cannot prevent a continued intimacy between the inspector and those under him which may lead to undue leniency. To overcome this difficulty, and to deal with any unauthorised practices that might be concealed from uniformed inspectors, the tramways at Aix-la-Chapelle, Amsterdam, Astrakhan, Berlin, Budapest (2 lines), Cairo, Christiania (2), Cernowitz, Paris (2), Petrograd, and Stockholm employ plain clothes inspectors. These are unknown to the general staff, and even to the other inspectors, so that by travelling with ordinary tickets they are able to see all that takes place without their presence being suspected. The observations of these men give the authorities information of facts of which they might otherwise be unaware, and often enable them to take action before serious troubles arise. At the same time the employees, knowing themselves to be under observation, are much less likely to engage in undesirable practices. We are glad to say that the inspectors' reports are not by any means entirely devoted to censures, but that they very often include incidents reflecting credit upon the men. In our case, and doubtless in others also, such occasions are made the opportunity of expressing satisfaction, or if the occasion warrants it of bestowing a reward on those concerned. From another point of view, these inspectors will sometimes discover incorrect behaviour on the part of passengers, and for such occasions we provide them with written authority which they can produce if necessary. There can be no question of the importance of carefully selecting and training men destined for this work, as their reports can be of no value unless absolutely trustworthy. They have to understand that it is not at all to their interest to bring up numerous cases, but only that all reports shall be strictly accurate ; any misstatement or even a simple mistake rendering them liable to instant dismissal. They are also directly forbidden to provoke employees with the object of reporting their conduct. The majority of the undertakings that have made use of such plain clothes inspectors declare themselves quite satisfied with the results.

I am aware that the foregoing summary is far from exhausting all the details of the conscientious replies received to the forty-eight questions, and am sure that anyone wishing to go more carefully into one or more questions of detail will find therein much interesting data.

LONDON UNITED TRAMWAYS COMPANY.

At the annual general meeting of the London United Tramways Company Limited, the chairman, Mr. W. M. Acworth, said the gross receipts of the undertaking for 1918 were £362,426, and the expenses were £373,831, making a loss of £11,404. Adding debenture and loan interest and the losses on the previous two years, the deficiency amounted to £94,050. The directors attributed the increase in working expenses to advances in costs of labour and materials. Their wages bill was 60 per cent. above what they paid for labour before the war, and materials had increased in cost by over 100 per cent.

In November last the Bill they had promoted in Parliament passed into law ; the negotiations with the first mortgage debenture holders for the rehabilitation of the company's finances had been brought to a successful conclusion.

By their Act of Parliament the right to purchase held by the twenty different local authorities whose areas the company's system traversed, dated at various years between 1924 and 1935, was postponed to a uniform date in 1950. In addition, the Act conferred upon the company authority to make a substantial increase upon their statutory fares.

Under the financial scheme of the Act, their total capital had been reduced by more than £1,500,000, and their debenture debts by nearly £900,000. Arrears of interest had been cancelled, and for the year 1918 the scheme provided that interest was only to be paid on the reduced amount of the debenture stock. That interest, amounting to £34,313, was duly paid on May 6. It followed that this interest was the only fixed charge they would have to meet during the next few years.

This was a very important point, as before the undertaking could recover its full earning powers, and receive the full benefit of the increased fares, a considerable amount of reconstruction work must be carried out. It was an important feature of the agreement with the debenture holders, as sanctioned by the court, that the £235,000, representing the purchase price payable by the London County Council for the Hammersmith tramways undertaking, was to be set free by the debenture holders, and placed at the company's disposal as part of the £400,000 to be devoted to purposes of reconstruction.

Mr. H. A. Vernet seconded the motion. The resolution was carried unanimously.

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LIVERPOOL CORPORATION TRAMWAY CARS.

In earlier pages of this issue are described the new cars that are just being completed for Liverpool Corporation Tramways. In addition to the cars now on order, the Corporation has 600 cars of various types, which are enumerated in the following tables, in which are given the types of motors, trucks, and the seating capacity of the respective classes :—

Single-deck American cars, with side entrance	12
American cars, fitted with upper deck, reversed staircase ...	3
Double-deck, single truck cars, with ordinary type of staircase, uncovered	21
Double-deck, single truck cars, with ordinary type of staircase and top covers	90
Double-deck, single truck cars, fitted with reversed staircase and canopy tops	449
Double-deck, single truck cars, fitted with double staircases and canopy tops	24
Double-deck, double truck car, with double staircase and canopy top	1
Total	600

Type.	Number of Cars.	Motors. Type.	Motors. H.P.	Type of Truck.	Passengers. Inside.	Passengers. Outside.	Licenced Capacity
American single deck	12	Walker ...	35	Brill .	40	—	54
American double deck	2	Walker ...	35	Brill ...	40	60	124
American ,, ,, ...	1	Walker ...	35	Brill ...	40	56	120
British Thomson-Houston double deck	12	B.T.H. ...	25	Peckham	22	28	65
Westinghouse double deck...	3	Westinghouse...	25	Peckham	22	28	65
Liverpool ,, ,, ...	6	Walker ...	25	Brill ...	20	26	61
Liverpool ,, ,, ...	3	Walker ...	25	—	22	42	73
Preston ,, ,, ...	90	Walker ...	25	Brill ...	22	30	61
Liverpool ,, ,, ...	15	Westinghouse...	35	Brill ...	22	42	73
Liverpool ,, ,, ...	53	Dick-Kerr 3 A4	35	Brill ...	22	42	73
Liverpool ,, ,, ...	3	Dick-Kerr 9 ...	35	Brill ...	20	40	73
Liverpool ,, ,, ...	2	Walker ...	25	Curtis ...	24	42	75
Preston ,, ,, ...	128	Walker ...	25	Brill ...	22	42	73
Liverpool ,, ,, ...	58	Dick-Kerr 20 ...	40	Brill ...	22	40	71
Preston ,, ,, ...	186	Dick-Kerr 20 ...	40	Brill ...	22	42	73
Liverpool ,, ,, ...	1	Siemens ...	35	Brill ...	22	40	71
Preston double deck (Twin Staircase)	1	Dick-Kerr 20 ...	40	Bogie ...	32	51	83
Preston ,, ,, (Twin Staircase)	1	Dick-Kerr 20 ...	40	Brill ...	32	40	72
Liverpool ,, ,, (Twin Staircase)	22	Dick-Kerr 20 ...	40	Brill ...	32	40	72
	1	Dick-Kerr 20 ...	40	Peckham	30	40	70

NOTE.—Sixty-eight of the above cars are operated as first-class cars, with a seating capacity of 20 inside and 38, 40, and 42 outside.

FINANCIAL REPORTS AND MEETINGS.

HALLEY'S INDUSTRIAL MOTORS.—The directors announce an interim dividend of 5 per cent. actual, less tax.

BELSIZE MOTORS.—The report announces an interim dividend on ordinary shares of 4 per cent. actual, less tax.

JOHNSON AND PHILLIPS, LIMITED.—A dividend is announced of 10 per cent. per annum on ordinary shares for 1918.

DEFICIT AT DARLINGTON.—There has been a loss on Darlington Corporation Tramways of £1,761 during the past year.

BRITISH COLUMBIA ELECTRIC RAILWAY.—An interim dividend of 2½ per cent. is announced on the deferred ordinary stock.

AUCKLAND TRAMWAYS.—A distribution is announced of 6d. per share, less tax, on account of dividend for the year ending June 30.

SIEMENS BROTHERS.—In their annual report, the directors recommend a final dividend of 5s. per share, making a total dividend for the year ended December 31 of 10 per cent., free of tax.

THE EDISON-SWAN ELECTRIC COMPANY, LIMITED.—The directors have declared an interim dividend of 3 per cent. (less income tax) in respect of old ordinary shares, for the year ending June 30, 1919.

COLNE CORPORATION TRAMWAYS show a loss for last year of £3,004. This sum was considerably larger than the estimated deficit, and the excess is attributed to the increase in wages and higher cost for energy.

CITY OF BUENOS AYRES TRAMWAYS.—The directors of the City of Buenos Ayres Tramways Company (1904) have declared a dividend of 1s. 3d. per share (being at the rate of 5 per cent. per annum), less income tax, for three months ended March 31 last.

ELECTRIC CONSTRUCTION.—For the half-year ended on March 31 the directors of the Electric Construction Company recommend a final dividend at the rate of 9 per cent. per annum on the ordinary shares, making 7½ per cent. for the year; they also recommend payment of a bonus of 2½ per cent. on the ordinary shares, less tax.

SHANGHAI ELECTRIC CONSTRUCTION COMPANY.—A dividend is announced at 5 per cent., and a bonus of 5 per cent. (making 20s. per share) less income tax on the ordinary shares, making 15 per cent. for the year. The sum of £10,000 is placed to reserve for renewals, £8,000 is written off preliminary expenses, and £19,103 is carried forward.

HADFIELDS, LIMITED.—Following on the increase of capital to £2,000,000 by the creation of 1,300,000 ordinary shares of £1 each, the directors of Hadfields, Limited, have decided to issue 800,000 of these shares as fully paid in the proportion of two new shares for every share held; 400,000 additional shares are offered to shareholders in the proportion of one new share for every share held, at 30s. per share. The right of renunciation is given and the allotment letters can be split.

OLDHAM, ASHTON, AND HYDE TRAMWAYS.—The revenue for 1918 amounts to £50,704, and expenditure (including £1,178 for debenture interest) to £33,347, leaving a net profit of £17,357, and £3,100 was brought in, making £20,457, which is thus disposed of :—To reserve £10,000 (raising it to £54,514); £5,500 further dividend on ordinary, making 6 per cent.; forward, £4,957. Arrangements are being made to refer to arbitration, in accordance with the provisions of the Tramways Act, 1870, the question of the price to be paid to the company by the various purchasing local authorities.

BOURNEMOUTH AND POOLE.—The annual report of the general manager of Bournemouth Municipal Tramways shows that the revenue for the year was £148,449, an increase of £16,776 over the previous year. The surplus has also increased from £26,329 to £31,950. On the other hand, the operation of the Poole section of the system shows a deficit of £8,462, and Mr. Bulfin, the general manager of the tramways department, anticipates that "in the coming year, under present conditions, this loss will be considerably increased." Poole Corporation refuses, in face of every argument advanced by the Tramways Committee of Bournemouth, to allow an increase of fares on the route under their authority.

BLACKPOOL CORPORATION TRAMWAYS.—The report by Mr. Charles Furness, the manager, shows that for the year ended March 31 last the revenue was the highest on record, namely, £140,929, as against £119,339 in the preceding year. The total expenditure was £90,003. Interest and redemption of loans absorbed £20,844, which left a disposable balance of £30,052, as compared with £31,518 in the previous year. The decrease (notwithstanding such an advance in the total receipts) is accounted for by the higher wages and the high cost of materials. The number of passengers was 23,279,202, being three millions more than in the preceding twelve months. The car mileage was 1,242,108, and the receipts per car mile 2s. 2½d., being 5d. more than in 1918.

BRITISH WESTINGHOUSE ELECTRIC AND MANUFACTURING COMPANY LIMITED.—The report for the year ended December 31 shows that the sum available, including the balance of £51,534 brought from last year's account, amounts to £198,152. The following appropriations have been made :—To special depreciation of plant, machinery, etc., £42,315, dividend on cumulative preference shares at 8 per cent., less income tax, £78,090, balance carried forward, £77,747. The report states that during the year Mr. Lincoln Chandler has resigned the position of managing director, but retains a seat on the board. Captain R. S. Hilton has been appointed

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managing director. In accordance with the undertaking given by the Metropolitan Carriage, Wagon, and Finance Company, Limited, 1,000,000 ordinary shares of the company have been applied for, and have been allotted at par.

LONDON AND SUBURBAN TRACTION COMPANY.—The directors in their report for the year ended December 31, 1918, remark that the continuation of war conditions has intensified the difficulties of the company's undertakings. Shortage of labour and the difficulty of obtaining material has caused a reduction in the number of cars in service, while the operating expenses have increased as a result of additional wages and higher cost of fuel. In consequence of the decrease in dividends received from the subsidiary companies, and to the Tramways (M.E.T.) Omnibus Company finding it necessary to make provision for an early renewal of its fleet, the directors are unable to recommend the payment of any dividend on the preference shares. The gross revenue for the past year amounted to £46,294, as compared with £81,519 for 1917. After deducting all expenses, including debenture and loan interest, and providing for the sinking fund charges on the 5 per cent. debenture stock, there remains a balance of £3,458, making, with £3,634 brought forward, a total of £7,092, which is carried to the next account.

PERSONAL.

Mr. C. R. Everson, manager of Plymouth Corporation Tramways, is retiring on a pension.

Mr. D. Tarbert, cashier of Hull Corporation Tramways, has been appointed manager pro tem.

Mr. E. B. Wedmore has been appointed as director of Research by the Electrical Research Committee.

Nelson Council have increased the salary of the electrical engineer and tramways manager, Mr. G. F. Nayler, by £100.

Mr. J. B. Horner, traffic superintendent of Wigan Corporation Tramways, has been granted an increase in salary of £50 to £250.

Mr. S. C. Tranter, relief charge engineer, London County Council Tramways, has been appointed charge shift engineer, at a salary of £250, rising to £300.

Mr. R. Q. Robertson has been appointed manager of White Motors and Accessories, Limited, in succession to Mr. W. J. M. Bell, who has severed his connection with the company.

Mr. E. M. Lacey has been appointed consulting engineer by Aberdare Council in connection with the extension of the tramway services. The extensions are estimated to cost £100,000.

Sir Auckland Geddes has been appointed President of the Board of Trade, and it is understood that he will postpone taking up his duties as President of McGill University (Montreal) until next year.

Mr. Frank Wood, borough engineer of Fulham, has been recommended for appointment to the position of borough engineer and surveyor of Blackpool, in succession to the late Mr. J. S. Brodie.

Mr. P. V. Hunter, chief electrical engineer of Messrs. Merz and McLellan, has resigned that position to join the management staff of Callender's Cable and Construction Company, Limited.

Inspector E. Challoner, after serving 18 years with Sheffield Corporation Tramways, advancing from conductor to inspector, has been appointed chief inspector of Accrington Corporation Tramways.

Alderman Sir Charles W. Starmer has resigned the position of chairman of the Darlington Tramways and Electricity Committee as a result, it is stated, of unfair criticism by certain members of the Council.

Mr. A. R. Fearnley, general manager of Sheffield Corporation Tramways, has been given permission to assist London County Council in connection with their motor omnibus proposals in their Parliamentary Bill.

Mr. E. W. Sleight has resumed his duties as manager of the Carlisle Tramways Company, on returning from the army. He served in the Royal Fusiliers and King's Own Lancashire Regiment, and was severely wounded.

Mr. C. A. Hopkins, of the Chatham and District Light Railways Company, and formerly of the Swindon Corporation Electricity and Tramways Department, has been appointed chief clerk to the Wigan Corporation Tramways.

Bournemouth Manager's Salary.—The Tramways Committee has recommended the Bournemouth Town Council to increase the salary of Mr. I. Bulfin, tramways general manager, to £1,000 a year, rising by annual increments of £50 to £1,250.

Mr. Thomas D. Kirkland, who has recently returned from service with the forces, has been appointed manager of the Stirling and Bridge of Allan Tramways Company, in succession to Mr. Andrew Henderson, who has resigned owing to ill-health.

Mr. Harry S. Ellis, borough electrical engineer of South Shields, has been appointed to succeed Mr. H. F. Street as borough electrical engineer of Southampton, at a salary of £800 per annum. Mr. Ellis is the son of the late Sir J. B. Ellis, of Newcastle.

Mr. W. P. Young has been recommended by the Tramways Committee of Edinburgh for appointment as traffic superintendent of the Corporation Tramways. Mr. Young, who is a native of Aberdeen, is at present principal assistant to the manager of Belfast Corporation Tramways.

Mr. F. C. Raphael has been appointed manager of the cable and wire department of the Edison-Swan Electric Company, Limited, on his release from the army. Shortly after the outbreak of war he joined the Royal Naval Anti-Aircraft Corps, but in February, 1916, he obtained a commission in the London Electrical Engineers.

Mr. E. M. Munro has ceased to act as representative of Messrs. Brecknell, Munro and Rogers in the London area as from May 31, but he will continue to act in an advisory capacity to the firm. **Mr. A. M. Willis** had been appointed as representative of the firm in the London area, and all communications should in future be addressed to the head office, Thrissell Street, Bristol.

Mr. B. L. Pope, distribution engineer (southern section) of the London County Council Tramways, is retiring owing to ill-health. He entered the Council's service on February 1, 1902, and the Highways Committee have reported that he has rendered valuable service during the whole of the time he has spent with the Council. They recommend that a retiring allowance be granted to him.

Hull Tramways Committee.—The new chairman of the Hull Tramways Committee, Colonel Walker, has been elected chairman of the Staff Sub-Committee, the vice-chairman, Mr. Willoughby, chairman of the Traffic Sub-Committee, Mr. Wokes, chairman of the Finance and General Committee, Mr. Richardson, chairman of the Stores Committee, and Mr. Gibson, chairman of the Claims Sub-Committee.

Mr. Arthur H. Pott, having resigned his position as general manager and engineer to the Metropolitan Electric Tramways, Limited, and the London United Tramways, Limited, is starting in practice as a consulting engineer, but is still retained by the companies mentioned above in an advisory capacity. His temporary address is care of Messrs. F. W. Hayne and Company, 80, Bishopsgate, E.C.2. (Telephone No., London Wall 9574.)

Sir George Gibb's Dual Position.—In the House of Commons, on May 19, Mr. Joynson-Hicks asked if it was the case that Sir George Gibb had returned to the service of the North Eastern Railway Company, while continuing to act as chairman of the Road Board. Mr. Chamberlain, in reply, stated that Sir George Gibb's present connection with the North Eastern Railway Company is in an advisory capacity only, and does not preclude his full discharge of his duties at the Road Board.

Colonel S. B. Smith, O.B.E., who has been appointed manager of the Bristol Tramways and Carriage Company, in succession to Mr. Charles Challenger, who has retired and has been appointed a director, has rejoined his old battalion, the 6th Territorial Battalion, Gloucester Regiment, as major and second in command of the 2/6th Battalion. He was attached to the Royal Flying Corps from May, 1915, and became Lieutenant-Colonel, R.F.C., in May, 1916, and acting Colonel on the formation of the Royal Air Force on April 1, 1918.

Leeds Manager's Salary.—The Leeds City Council has approved the recommendation of the Tramways Committee, increasing the salary of Mr. J. B. Hamilton, the general manager, by £500, making his total annual salary as tramways and commercial manager £2,000. Alderman R. A. Smithson, chairman of the Tramways Committee, in moving the recommendation, said that Mr. Hamilton was appointed in 1902 at a salary of £900, increasing a year later to £1,000. The traffic receipts were then £220,000, while last year they were £723,000. The staff had increased from 1,000 to 2,200.

Mr. B. S. Rayner, borough electrical engineer and tramways manager of Doncaster, has been granted an increase in salary from £550 to £700 for one year, and then to £750. Councillor S. Balmforth, chairman of the Electricity and Tramways Committee, said the traffic on the tramways was three times as great as it was in 1914, though they had not been able to increase the rolling stock. Councillor H. M. Marshall, who supported the recommendation, said that Mr. Rayner had recently proposed a plan for the extension of the system, involving an estimated expenditure of £40,000.

Capt. Ernest E. Sharp, who is known to most tramway managers in connection with his advocacy of the use of meters on tramcars as an antidote to bad driving, has now been demobilised after three years' service, much of it in France. He is relinquishing his position with Messrs. Chamberlain and Hookham in order to start a new enterprise which will appeal to tramway managers. At the moment he is not able to furnish particulars, but will do so shortly. Meanwhile his address is 109, West Side, Clapham Common, London, S.W.4, where he will be pleased to receive any communications from old friends.

Private Fred A. Dowers, R.F.A., a former employee of the Cardiff Corporation Tramways, was presented at the conference of the Amalgamated Association of Tramway and Vehicle Workers with a gold watch, in recognition of his having been awarded the Military Medal. His wife was presented with a silver tea service. Private Dowers was awarded the M.M. for cutting wires under heavy shell fire. The Lord Mayor of Cardiff welcomed him home, and said they were very proud of him and of the decoration he had won.

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Private Dowers was the seventh Cardiff tramway employee who had gained distinction, two others having been awarded the D.C.M., and four others the M.M.

Lieut. L. C. Bellamy has been selected for the position of manager of the St. Helens Corporation Tramways, and will begin duty when the undertaking has been transferred to the Corporation in October next. Lieut. Bellamy is the eldest son of the late Mr. C. R. Bellamy, general manager of the Liverpool Corporation Tramways. After spending some time in the office of the Liverpool Tramways, he became assistant manager of the St. Helens Tramways, and later was for two years assistant manager of the Rangoon Tramways Company. On returning to England, he was appointed general manager of the Ilkeston Corporation Tramways and electrical undertaking, leaving that post when the war broke out to join the Royal Engineers. He has seen service in Gallipoli, France, and Belgium, and was awarded the M.C.

TRAMWAY AND LIGHT RAILWAY NOTES.

BELFAST.

A Deputation to Study Cars.

In order to obtain first-hand information as to the latest types of cars, Alderman Tyrrell and Councillors Turner, M'Donald, Andrews, and Dempsey, with the general manager (Mr. J. S. D. Moffet) have been appointed a committee to visit Liverpool, Manchester, Sheffield, Leicester, Loughborough, Nottingham, London, and Birmingham.

BRADFORD.

An Order for Twenty-six Cars.

Alderman E. Priestley and Councillor I. F. Akeroyd, chairman and deputy chairman of the Tramways Committee, have been authorised to order twenty-six new sets of car motors, fitted with the Spencer-Dawson patent oil brake. Messrs. Dick, Kerr and Company, who are building twenty-six new cars, hope to begin delivery by the end of June, and to complete the order by August. Even when all the cars are delivered the services will not reach the pre-war level, as they will only replace cars now in use, but which are worn out.

CARDIFF.

Fares and Queues.

At a recent meeting of the Corporation Electric Lighting and Tramways Committee, a letter from the National Union of Railwaymen was read, in which it was alleged that the tramway fares were 200 per cent. above pre-war rates, and protesting against the continuance. Sir John Courtis, chairman of the committee, said that the increase in fares amounted only to 16 per cent. on the highest pre-war rates and 50 per cent. on the lowest. Complaints had been received, alleging that the crushing at the car stations and termini had become serious, degenerating into a scramble. Mr. Arthur Ellis, general manager and engineer, intimated that arrangements were being made for the adoption of the queue system wherever possible, that method having been used on one route already with the best results.

DOUGLAS.

Increased Fares.

The Isle of Man Legislature has authorised Douglas Corporation to increase the fares on their tramways by 50 per cent. During the war the tramways made a loss of over £12,000.

DUNDEE.

Height of the Car Steps.

Complaint having been made to the Corporation Tramways Committee that the tramcar steps were too high, Mr. P. Fisher, general manager, has explained that from the construction of the Dundee cars, and the fact that there was only three feet separating the rails, as compared with four feet in most other places, it was not an easy matter to lower the car steps. The committee recommended that Mr. Fisher should consult with the makers of the cars as to how the difficulty might be got over, and at the same time to arrange for improvement of the new cars on the lines indicated.

HULL.

Reconstitution of the Tramways Committee—Tramways Power Supply.

Following the resignation of Mr. W. J. McCombe, manager of the tramways department, the Hull City Council appointed a special committee composed of seven members of the Council to investigate the management of the department. At a special meeting of the Council on May 12, Mr. Digby Willoughby moved:—"That the resolution passed by the Council on November 9, 1918, appointing the members of the Tramways Committee until November 9 next, be rescinded, and that a committee consisting of twelve members (in addition to the Lord Mayor and ex-Lord Mayor *ex-officio*) be appointed to have the management and control of the tramway undertaking of the Corporation." The resolution was carried by 24 votes to 4, and at a later meeting five new members and seven old members were elected to constitute the committee. Col. Walker, the new chairman, said they would have to pursue a vigorous policy in order to get a good and efficient service. Their financial position must be improved. The Electricity Committee and the Tramways Committee have approved the proposal that power for the tramways shall be obtained from the Electricity Committee's station. Hitherto the current has been supplied from the tramways department's station.

LEEDS.

No Liability for a Detached Trolley Head—Free Rides Withdrawn—Piecemeal Renovations.

An interesting decision was given by Judge Parfitt in Leeds County Court on May 1, in an action brought by a railway guard against Leeds Corporation for damages. The trolley head of a car on which plaintiff was a passenger came off and struck him, rendering him unconscious. The Judge held that it was impossible to find defendants guilty of negligence. It ought to be more publicly known that defendants were under no greater obligation to use reasonable care in the manipulation of their system than if it belonged to an individual. The obligation was that reasonable care must be taken to maintain the system in a condition of safety, and, in his judgment, defendants had done so. Judgment was given for defendants, but without costs, as plaintiff had sustained serious injuries. The privilege that sailors and soldiers have enjoyed of riding free on the cars has been withdrawn except as regards men in hospital uniform. The Tramways Committee are giving serious attention to the task of making good the wear and tear during the past four years. Owing to the scarcity of labour and materials, it is impossible to undertake any comprehensive scheme, and the work must be done piecemeal as materials come to hand. Repairs are urgently needed to both rolling stock and tracks, but the *Yorkshire Post* states that the committee have no intention of going abroad for material.

LIVERPOOL.

A Deputation to America Cancelled—Revision of Fares.

Some time ago Liverpool Council agreed to the recommendation of the Tramways and Electric Power and Lighting Committee, that a deputation be sent to United States and Canada to investigate traction systems in view of the fact that the Corporation must shortly make plans for the extension and improvement of transit facilities. The minutes of the committee contained a recommendation that the Council authorise the payment of the actual disbursements of the deputation in lieu of the usual scale of travelling allowances. Sir Archibald Salvidge opposed the recommendation. He pointed out that the chairman of the committee had volunteered the information that the deputation would cost something like £400 per man. The Council had reduced the number to nine, and the tramway manager had intimated his inability to accompany the deputation, owing to urgent needs of the department. Sir Archibald asked the chairman of the committee to withdraw the whole proposal. The recommendation of the committee was defeated, and Alderman Russell Taylor agreed that the resolution sanctioning the deputation should be rescinded. The Corporation on May 9 accepted the recommendation of the Tramways Committee that, in consideration of the additional expenditure caused by the reduction of working hours of the employees, and the increased cost of materials, the revised scale of fares recommended by the general manager on the basis of a stage of 1½ miles for 1d. and the consequent modification of the other stages be approved. Strong opposition was offered, but the chairman of the committee submitted figures showing a deficit of £81,942. The increased cost of labour, material, etc., for 1919, as compared with 1913, was £639,964. The recommendation was carried by 47 votes to 24.

LONDON.

A Suggestion for Lighting Authorities—"Freedom from Accidents" Competition—London United Company's Fares—Stepney Accepts the Overhead System—Open Trailers Asked for—Map and Guide—Disabled Employees—Bonus to Car Crews.

The London Safety First Council, at a meeting held at the Westminster Guildhall, adopted a recommendation from the Street Lighting Sub-Committee to invite Metropolitan public lighting authorities, when able to increase street lighting, to give preference to omnibus and tramway routes, and to extend efficient lighting to entrances to side streets at points approaching main thoroughfares. The Council also resolved to conduct another competition during 1919 to encourage, by the award of money prizes and badges, drivers of all classes of road vehicles, including tramway cars, to exercise every care and discretion in the performance of their duties. Further increases of fares on the London United Tramways have been sanctioned by the Board of Trade, bringing the increases since 1914 up to 100 per cent. By a resolution passed at a meeting of Stepney Borough Council, a veto has been removed which obstructed the development of the tramway system through Stepney, Poplar, and Bethnal Green. For a long period Stepney Council have held out for the installation of the conduit system in Burdett Road, and the County Council offered instead the trolley system. Stepney Council have now accepted the latter offer. Mr. Bridgeman, Parliamentary Secretary to the Board of Trade, replying to Colonel Archer-Shee in the House of Commons on May 23, said that the Board of Trade had no power to compel the London County Council to run open trailer cars. The Council had been authorised by

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Parliament to run trailers on certain routes, and did in fact run them. Colonel Archer-Shee asked whether the hon. member would represent to the Council that the number of these cars was nothing like sufficient, and Sir F. Hall asked if it was only after considerable trouble with the police that permission was given for the running, and that the police tried to hold it up. Mr. Bridgeman replied that this was not a matter for the Board of Trade, but that he would make representations if that was desired. The County Council have sanctioned an expenditure of £660 for the further issue of 500,000 copies of the tramways map and guide. An arrangement has been approved under which a specially selected official in the tramways department will give attention to disabled men returning from war service in order to facilitate their return to their former positions, or to such suitable positions as can be found for them in the tramways department or in other departments. Coal saving bonuses of £1,614 and £1,077 for the quarters ended September 25 and December 25, 1918, respectively, have been distributed among the motormen and conductors in the tramways department.

MANCHESTER.

THE CITY'S CAR REQUIREMENTS.

At a meeting of Manchester City Council, on May 21, Alderman Chapman, deputy chairman of the Tramways Committee, said that they hoped to provide one hundred more tramway cars this year. Each of these would cost over £2,000. In pre-war times similar cars would have cost about £800.

NEWCASTLE-ON-TYNE.

SUPPORT FOR A CENTRAL INDUSTRIAL COUNCIL.

The City Council have approved the report from the Tramways Committee recommending the scheme for a Central Industrial Council of Tramway Employers and Workers, in accordance with the recommendations of the Whitley Report. The full constitution of the Joint Industrial Council for the Tramway Industry was given in our issue of March 13, 1919.

ST. HELENS.

PURCHASE OF THE COMPANY'S TRAMWAYS.

St. Helens Tramways Committee have decided to purchase thirty-six tramway cars from the company. The Corporation will take over the working of the tramway service in September. Mr. L. C. Bellamy has been appointed manager of the undertaking. The salary is £400, rising by annual increments of £25 to £500. The committee propose to make application to the Board of Trade for sanction to borrow £25,000 for tramway purposes.

WALLASEY.

AMERICAN PRACTICE NOT APPLICABLE TO BRITISH TRAMWAYS.

Wallasey Town Council have decided not to send a deputation to America. In the course of a discussion one of the members expressed the opinion that they had men at home quite as capable of dealing with their tramways as anyone in America. The discussion indicated that in the opinion of the Council American methods were of little value as models for British tramway practice.

CONTRACTS AND ORDERS.

Sunderland Council have accepted the tender of B. I. and Helsby Cables, Limited, for l.t. feeder and service cables.

Bolckow, Vaughan and Company, Limited, have received an order for 200 tons of tramway rails, B.S.S. No. 2, from Exeter Corporation.

Johnson and Phillips, Limited, are supplying sub-station switchgear to Hackney Borough Council. The amount of the order is £7,183.

Leeds Tramways Committee have recommended the acceptance of a tender of the British Westinghouse Company for a rotary converter.

Smith and Coventry, Limited, are supplying a 36-in. plain horizontal milling machine, complete with motor and starter, to Bolton Tramways Committee.

Callender's Cable and Construction Company's tender for mains to be supplied during the coming year has been recommended for acceptance by Walsall Town Council.

The Brush Electrical Engineering Company's tender for ten double-deck, top-covered car bodies, with vestibules, has been recommended for acceptance by Walsall Town Council.

Rotherham Council has placed an order for four double deck tramway cars with Dick, Kerr and Company, Limited, at £2,190 each, and 12 new bodies without top covers at £1,705 each.

Bolton Electricity Committee have recommended the acceptance of the following tenders Supply of cable for 12 months, British Insulated and Helsby Cables, Limited, I. Frankenburg and Sons, Limited, and W. T. Henley's Telegraph Works Company, Limited.

Bonus on Steam Consumption to Contractors.—The Highways Committee of the London County Council have sanctioned the payment of a bonus of £1,500 to the British Westinghouse Electric Company, Limited, on the steam consumption under the terms of their contract in respect of two turbo-generators erected by the company at the Greenwich power station of the tramways.

PATENT LIST.

Abstracted for "The Tramway and Railway World" from the Official Journal of Patents.

***** If the inventions have been communicated the names of the communicators are given in italics.**

APPLICATIONS FOR LETTERS PATENT.

The number of the patent is given in brackets.

Disc wheels for motor vehicles (10,695)—W. Beardmore and Company.
Lamp signals in overhead wire systems of electric traction (10,932)—Brecknell, Munro and Rogers and A. M. Willis.
Gearing (10,492)—British Thomson-Houston Company (*General Electric Company*).
Change-speed driving gear (11,003)—M. Brown.
Transmission and gearing for motor cars (10,724)—J. L. Clifford.
Automobiles (10,849)—A. E. Cole.
Mechanically propelled vehicles (10,632)—A. J. Roach-Cuming.
Single, variable, or multiple speed gear driven axle and differential for motor propelled vehicles (10,790)—A. R. Garnett and S. O. Needham.
Variable speed driving mechanism (10,925)—F. W. Gostick.
Variable speed gear (10,988)—H. F. Harper and H. S. Hulme.
Variable speed and reversing gear (11,087)—T. J. Heskett.
Variable speed friction device (10,821)—R. Lowe and E. Wainwright.
Driving mechanism for mechanically propelled vehicles (10,863)—W. Mason.
Joints of rails (10,522)—J. Quinlan.
Convertible body for automobiles (10,659)—A. V. Roe.
Back axles of motor vehicles (11,047)—J. Y. Sangster.
Engine bonnets and cooling arrangements of motor vehicles (11,049)—J. Y. Sangster.
Differential gear for self-propelled vehicles (10,494)—J. C. Schulmayer.
Mechanically propelled road vehicles (10,862)—J. H. Sinclair.
Elastic tires for motor vehicles (10,481)—J. M. Whyte.
Signalling device for use on motor vehicles (11,805)—A. Allchin and A. W. Allchin.
Central drive motor car wheel (11,121)—W. E. Beasley.
Motor car starting handle attachment (11,148)—E. D. Bellamy and C. F. Fitch.
Means for supporting rails (11,207)—C. F. Bengough.
Means for detachably securing pneumatic tires to wheels (11,273)—A. Bennett.
Fuel systems for internal combustion engines for motor vehicles (11,521)—A. E. Berriman and Daimler Company.
Differential and variable speed gear for motor vehicles (11,610)—A. J. Berry and G. M. M. Berry.
Motor vehicles (11,260)—S. A. Bird.
Automatic air brake equipments (11,297)—British Thomson-Houston Company (*General Electric Company*).
Attachment for wheels of motor vehicles (11,372)—E. J. Cayless.
Apparatus for heating tramway or railway cars (11,500)—J. Charpentier.
Pneumatic tires for automobiles (11,491)—F. Creassey.
Tramway and railway truck axles (11,231)—F. H. Critchley and R. Sarginson.
Automobiles (11,747)—R. Eastwood.
Motor vehicles (11,755)—F. L. Freeman.
Means for attaching car bodies to motor chassis (11,155)—W. H. M. Higham.
Means for cooling cylinders of automobile engines (11,672)—H. Morgan.
Temporary axles for motor vehicles (11,400)—G. S. Owen.
Tramway rail (11,228)—J. H. Pestridge and L. J. Pestridge.
Variable speed gear mechanism (11,253)—H. C. Reading.
Engines and transmission systems of motor vehicles (11,118)—J. Y. Sangster.
Means for attachment and detachment of pneumatic tires to and from wheels of automobiles (11,760)—E. Vaughan.
Flexible couplings (11,136)—Birmingham and Midland Motor Omnibus Company and L. G. W. Shire.
Speed indicators (11,024)—R. Berry.
Self-oiling wheel for railway and road vehicles (10,455)—J. W. Boulton.
Motor vehicle driving mechanism (12,394 and 12,704)—Auto-Motive and Accessory Export Company.
Station and stopping-place indicators for trains, tramway vehicles, etc. (12,061)—H. Bingham.
Petrol or oil motor for motor cars (11,945)—C. Blair.
Fluid pressure brake apparatus (11,882)—British Thomson-Houston Company (*General Electric Company*).
Spring seats (11,900)—I. H. Brittain and the General Seating Company.
Driving axles for motor vehicles (11,834)—J. R. Churchill.
Automobile vehicles (12,419)—A. E. Cole.
Railway and tramway vehicles (12,496)—G. L. Cumberland.
Signalling apparatus for trains, etc. (12,271 and 12,418)—J. J. Daniels.

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Trailers for road vehicles (12,284)—R. N. Fairbanks.
Safety locking device for motor vehicles (12,297)—J. H. Farmer.
Variable speed power transmission mechanism (12,146)—M. L. Glover and Company and W. G. McCall.
Disc wheels for motor vehicles (12,196)—R. T. Harman.
Track brakes for tramcars, etc. (12,200)—J. Lacey.
Gear changing mechanism for mechanically propelled vehicles (12,491)—G. H. Lanchester and Lanchester Motor Company.
Railway, etc., steel coaches (12,107)—Metropolitan Carriage, Wagon, and Finance Company and L. Chandler.
Brake beams for railway, etc., vehicles (12,237)—Monarch Door Controller Company and J. Pettigrew.
Method for cooling water for motor car radiators (12,431)—F. Parker.
Steering wheel locking device for motor cars, etc. (12,432)—P. G. Peacock.
Implement for lifting motors (12,225)—H. Pedersen.
Brake blocks, etc. (12,227)—B. Smith.
Mechanism for locking steering wheels and control levers of motor vehicles (12,348)—T. A. Waters.
Lubricating devices (11,874)—Westinghouse Brake Company (*Westinghouse Air Brake Company*).
Self-propelled vehicle brakes (12,954)—J. T. W. L. Adair.
Railway, tramway, etc., locomotive (12,270)—J. A. F. Aspinall and the English Electric Company.
Means for automatically signalling when vehicle passes predetermined point in road (12,658)—E. Badger.
Power transmission mechanism of locomotives, railway motor cars, etc. (12,633)—Baguley Cars, Limited, and E. E. Baguley.
Automatic seat indicator for omnibuses and tramcars (12,879)—G. F. Bale.

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Trolley wheel fittings for trolley poles of electrically propelled vehicles (12,530)—J. P. Barker.
Mechanically propelled vehicles (12,779 and 12,780)—E. W. Bonson.
Safety valve or cut-off for mechanically propelled vehicles (12,781)—E. W. Bonson.
Locking devices for motor vehicles (12,861)—W. Charlesworth.
Safety locking devices for steering gear of motor vehicles (13,068)—J. G. Clark and S. J. Clark.
Means for locking steering wheels of motor vehicles (12,775)—A. J. Cooper and F. E. Cooper.
Fans for cooling engines of motor vehicles (12,604)—J. Cordner.
Locking device for starting handles of motor vehicles (12,536)—H. Dale.
Tramway vehicles (12,657)—T. Dunn.
Lifting jack (13,111)—H. R. d'Erlanger.
Motor vehicles (12,960)—H. Etchells, H. A. Greaves, and F. W. Highfield.
Signalling apparatus for road vehicles (12,513)—H. Fryman.
Anti-skid device for motor vehicles (12,744)—L. Green.
Means for steering trailers (12,715)—A. L. P. Hekking.
Friction driving and speed reducing gear, etc. (12,989)—C. E. Jones.
Lifting jacks (12,847)—A. E. Lake and Lake and Elliot.
Change-speed and reduction gearing (12,932 and 12,933)—T. Lumsden.
Trolley wheel fittings for trolley poles of electrically propelled vehicles (12,530)—C. W. Mallins.
Motor car exhaust silencer (12,795)—H. C. Morgan and W. J. Smith, Limited.
Locking devices for motor vehicles (12,813)—R. H. Morrison.
Indicator or signalling device for motor vehicles (12,913)—E. J. Perrin.
Method of springing overhead arm of tramcars, etc. (13,105)—H. L. Reilly.
Wheels for motor vehicles (12,572)—G. Roberts.
Starting devices for automobiles (13,053)—B. Rose.
Motor vehicles (12,885)—R. E. Simpson.
Motor tip wagons (12,269)—Walker Brothers and E. R. Walker.
Variable speed gear (12,826)—J. Wedderburn.

Specifications Published.

1916.

Vehicle wheels (7,568—*125,120*)—Dunlop Rubber Company, C. Macbeth, and F. J. Keegan.
Motor vehicles (9,365—*125,407*)—R. F. Macfie.

1917.

Speed changing devices for automobiles (16,362—*111,841*)—E. L. Conord.
Dynamo electric machines for use with internal combustion engines and vehicles propelled thereby (19,290—*115,414*)—Bijur Motor Lighting Company.
Air brake apparatus (16,216—*118,078*)—Automatic Straight Air Brake Company.

1918.

Speed changing, reversing, and braking gearing (3,713—*124,862*)—G. Pollard and Menco-Elma Syndicate.
Route indicators for tramcars, etc. (5,747—*124,886*)—B. W. Reed and G. R. Roberts.
Automobile rear axles (6,195—*124,908*)—J. St. L. Maher.
Variable speed gear (8,791—*124,955*)—G. Taylor.
Axle drive equipment for motor vehicles (17,719—*124,186*)—R. E. Fielder.
Brakes for railway, etc., vehicles (4,368—*125,191*)—J. N. Curtis and E. D. Sampson.
Electric signalling systems (6,146—*125,216*)—H. Green.
Spring mountings for motor vehicles (6,227—*125,223*)—Birmingham and Midland Counties Transport Company and G. E. D. Ralls.
Rims or road wheels of automobiles (6,595—*125,233*)—C. H. May.
Steering gear (6,670—*125,236*)—W. H. West and H. J. Inder.
Power transmission mechanism of railway motor cars (6,880—*125,240*)—Baguley Cars, Limited, and E. E. Baguley.
Route indicators for use on tramways and omnibuses (8,099 and *125,264*)—C. H. West.
Lifting jacks (11,274—*125,290*)—C. F. L. King.
Securing rails to tie-bars (16,585—*123,714*)—W. Dunn.
Joints of rails (6,928—*125,517*)—F. F. Benson.
Vehicle lifting jack (11,315—*117,458*)—M. P. Jackline.
Axle housings for motor vehicles and their manufacture (13,081—*125,553*)—F. B. Dehn (*Columbia Axle Company*).
Wheels for motor cars (5,276—*125,704*)—J. Martin.
Trollies or collectors for electric tramways (7,978—*125,792*)—E. R. Thomas.
Differential steering gear for motor vehicles (8,059—*125,794*)—G. M. Blackstone, F. Carter, E. Carter, and R. E. Watts.
Springing mechanism for motor vehicles (11,132—*125,838*)—P. G. Hugh and G. Scammell and Nephew.
Combined lifeguard and shields for the front wheels of motor omnibuses (21,067—*125,912*)—W. J. Wicks.

1919.

Lubrication systems (8,201—*125,930*)—British Westinghouse Electric and Manufacturing Company.

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TRAFFIC RETURNS.

Tramway and Omnibus Undertakings in the United Kingdom.

NAME OF COMPANY OR CORPORATION.	1918. WEEKS ENDED.					1919. WEEKS ENDED.					AGGREGATE.		
	May 4	May 11	May 18	May 25		May 3	May 10	May 17	May 24		Wks.	1919.	Increase or Decrease.
	£	£	£	£	£	£	£	£	£	£		£	£
Aberdare U.D. Council	...	...	...	...	...	...	...	...	...	...	—	—	—
Aberdeen Corporation	2,284	2,268	2,282	2,583	...	2,770	3,093	3,166	3,088	...	51	134,838	+ 23,198
Ayr Corporation	415	449	479	246	...	499	561	606	514	...	1	514	+ 268
Belfast City	7,760	7,738	7,714	7,901	...	9,462	9,740	10,158	10,612	...	8	79,753	+ 18,418
Birkenhead Corporation	2,100	2,099	2,185	2,475	...	2,365	2,427	2,480	2,949	...	7½	19,482	+ 2,774
Blackburn Corporation	1,792	1,672	1,672	2,954	...	1,977	2,157	2,350	2,425	...	8½	19,128	+ 4,197
Bradford Corporation	7,437	7,461	7,916	10,055	...	10,453	10,807	11,457	12,083	...	8	87,751	+ 24,827
Burnley Corporation	2,059	2,110	2,070	2,786	...	2,955	2,994	3,131	3,148	...	—	—	—
Burton-on-Trent Corporation	379	383	418	470	...	463	464	478	487	...	8	3,641	+ 525
Bury Corporation	1,771	1,974	2,067	2,831	...	2,219	2,306	2,422	2,405	...	7½	19,178	+ 3,694
Chatham and District	1,173	1,301	1,301	1,666	...	1,348	1,567	1,687	1,657	...	20	26,993	+ 2,454
Cork Electric	591	618	593	708	...	517	683	663	705	...	20	11,564	− 557
Derby Corporation	1,398	1,461	1,565	1,889	...	1,531	1,571	2,141	2,158	...	8	13,721	+ 1,947
Dundee City	1,621	1,590	1,695	1,718	...	2,151	2,211	2,260	1,907	...	½	1,907	+ 189
East Ham Corporation	1,365	1,398	1,427	1,809	...	1,693	1,955	1,981	2,016	...	7½	14,709	+ 4,006
Glasgow Corporation	28,068	28,385	29,508	30,355	...	31,608	32,196	33,523	34,396	...	51½	1,491,903	+118,463
Glossop (Urban Elec. Supply Co.)	178	182	181	240	...	218	227	225	225	...	21	4,622	+ 808
Halifax Corporation	2,644	2,489	2,571	4,255	...	3,072	3,215	3,367	3,513	...	7½	24,928	+ 4,809
Halifax Corp. Motor Omnibuses	55	55	58	92	...	70	74	76	77	...	7½	563	+ 118
Huddersfield Corporation	3,475	3,481	3,544	5,490	...	4,338	4,711	4,865	4,828	...	8	38,026	+ 7,957
Ilford U.D. Council	931	935	989	1,297	...	1,081	1,242	1,344	1,324	...	8	9,409	+ 1,933
Ipswich Corporation	647	683	756	1,061	...	719	847	909	857	...	8	6,416	+ 854
Isle of Thanet	199	215	263	413	...	624	768	855	913	...	33½	14,355	+ 7,828
Kilmarnock Corporation	226	239	248	244	...	288	316	370	309	...	1½	458	+ 84
Lanarkshire	3,812	3,463	3,659	3,978	...	1,093	1,881	3,692	4,045	...	20	63,716	− 4,866
Lancashire United	...	...	...	...	...	...	...	...	...	...	—	—	—
Leeds City	11 357	11,454	11,566	15,168	...	15,189	16,072	17,351	16,927	...	8	128,656	+ 37,148
Leicester Corporation	4,389	4,481	4,688	5,776	...	5,393	5,871	6,005	6,084	...	—	—	—
Leyton U.D. Council	1,901	2,033	2,098	2,626	...	2,580	2,993	3,270	3,259	...	8	24,090	+ 7,946
Liverpool Corporation	17.992	18,424	18,338	21,233	...	21,654	22,559	23,293	23,361	...	20½	433,588	+ 79,991
Llandudno and Colwyn Bay	338	333	367	...	...	483	511	523	...	...	24	8,556	+ 1,878
London County Council	57,175	58,565	60,065	72,089	...	72,154	81,277	82,685	84,039	...	7⅞	573,422	+144,171
Maidstone Corporation	242	268	251	340	...	336	352	379	365	...	7¾	2,873	+ 664
Manchester Corporation	24,885	25,382	25,248	30,144	...	29,026	30,465	31,083	31,737	...	8	238,058	+ 45,164
Newcastle-on-Tyne Corporation	8,749	8.569	9,246	10,361	...	8,730	9,037	9,283	9,230	...	8	70,623	+ 1,462
New St. Helens and District	...	...	...	...	...	...	...	...	...	...	—	—	—
Northampton Corporation	899	815	1,273	1,138	...	1,170	886	1,306	1,276	...	8	9,584	+ 2,442
Nottingham Corporation	5,618	5,693	5,776	7,471	...	6,668	7,185	7,366	7,274	...	8	53,243	+ 9,944
Oldham Corporation	...	...	...	4,363	...	...	...	...	4,625	...	9	37,460	+ 6,988
Reading Corporation	1,187	1,234	1,244	1,552	...	1,363	1,559	1,579	1,602	...	7⅞	11,398	—
Rhondda Tramways	...	...	...	...	...	...	...	...	...	...	—	—	—
Rotherham Corporation	2,020	2,043	2,411	2,257	...	2.253	2,261	2,319	2,247	...	8¾	19,097	+ 1,505
Sheffield Corporation	13,279	13,568	13,806	14,952	...	16,614	16,446	16,826	17,272	...	8½	147,322	+ 29,886
Southampton Corporation	2,397	2,493	2,446	2,978	...	2,436	2,674	2,731	2,754	...	7⅞	19,649	+ 1,094
Southend-on-Sea Corporation	730	853	873	1,604	...	1,424	1,596	1,773	1,824	...	8	12,453	+ 5,865
South Shields Corporation	...	...	...	...	...	...	...	...	...	...	—	—	—
Sunderland Corporation	2.034	2,092	2.021	2,493	...	2,682	2,708	2,851	2,888	...	8	22,415	+ 5,505
Swindon Corporation	321	324	280	...	...	296	303	335	...	...	6¾	2,031	+ 180
Torquay Tramways	847	752	750	1,172	...	949	1,070	1,044	1,090	...	20	17,184	+ 2,105
Tyneside Tramways and Tramroads	994	906	1,006	1,781	...	870	989	1,100	1,047	...	21	18,533	− 377
Wallasey Corporation	1,695	1,744	1,721	2.380	...	2,231	2,456	2,509	2,583	...	7½	19,088	+ 5,265
Walsall Corporation	1,181	1,194	1,206	1,680	...	1,392	1,384	1,389	1,416	...	8	11,099	+ 1,267
Walthamstow U.D. Council	1,311	1,412	1,505	2,056	...	1,483	1,827	1,983	1,959	...	8	14,332	+ 3,212
Warrington Corporation	741	763	712	850	...	865	892	875	885	...	7	6,699	+ 1,144
West Ham Corporation	4,009	4,150	4,235	5,122	...	4,907	5,535	5,768	5,676	...	7½	40,689	+ 9,292
Wigan Corporation	...	...	...	...	...	...	...	...	...	...	—	...	...

*** A number of undertakings suspended the issue of traffic returns for the duration of the war.

Colonial and Foreign Tramway Traffic Returns.

NAME OF COMPANY.	1918. WEEKS ENDED.					1919. WEEKS ENDED.					AGGREGATE.		
	May 4	May 11	May 18	May 25		May 3	May 10	May 17	May 4		Wks.	1919.	Increase or Decrease.
	£	£	£	£	£	£	£	£	£	£		£	£
Anglo-Argentine	57,721	59,028	56,634	54,104	...	65,483	56,085	64,295	60,808	...	20	1,165,255	+ 57,815
Calcutta Rs.	75,438	74,683	73,158	71,308	...	83,269	82,452	85,927	83,720	...	20½	1,746,109	+241,797
Madras Rs.	...	...	42,003	(2 weeks)	...	...	...	46,625	(2 weeks)	...	19	318,193	− 44,534
Pernambuco	4,441	4,302	4,323	4,300	...	5,566	5,806	5,688	5,725	...	20½	112,588	+ 16,897

Companies Issuing Monthly Statements only.

	1917.	1918.					1918.	1919.					Wks.	AGGREGATE.	
	Dec.	Jan.	Feb.	March.	April.	May.	Dec.	Jan.	Feb.	March.	April.	May.		1918-19.	+ or −.
	£	£	£	£	£	£	£	£	£	£	£	£		£	£
Ballarat & Bendigo	3,228	4,505	3,573	3,803	...	...	3,884	4,504	3,602	3,051	...	...	48	42,131	+ 1,444
Brazilian Trac. Mlrs.	8069000	7837000	7315000	8094000	8330000	...	8531000	8522000	7972000	9330000	9208000	...	17	35,032,000	+3,456,000
Brisbane	35,019	34,500	32,009	35,530	35,530	...	38,135	38,575	34,380	39,380	38,775	...	17	151,110	+ 13,541
British Columbia $	555,555	559,569	501,150	510,892	515,417	...	691,065	667,489	645,415	649,120	631,988	...	43	6,022,107	+1,011,419
Buenos Ayres L'c'z.	40.901	38,902	34,397	42,647	41,643	41,315	50,460	41,556	42,429	47,370	43,607	47,317	48	481,503	+ 52,123
Burma	26,224	25,430	22,985	27,906	27,614	...	34,593	38,265	35,926	38,440	36,815	...	39	325,985	+ 86,230
Cape Town	...	...	...	...	19,011	...	...	...	...	...	22,564	...	—	—	—
Carthagena & H.	4,424	4,011	4,031	5.316	4,200	5,027	2,950	3.655	2,351	2,400	1,786	3,226	21	13,418	− 9,167
Cordoba	...	12,844	12,972	...	...	...	...	13,942	13.549	...	...	...	48	159,203	+ 11,492
East India	1,099	1,176	1,318	1,729	1,791	1,920	2,048	1,970	1,689	2,016	1,920	2,131	43	19,679	+ 5,472
Kalgoorlie	3,044	2.522	...	...	...	...	2,848	2,562	...	...	...	...	4	2,562	+ 40
La Plata	4,606	4,711	4,746	5.348	5,169	5,105	5,792	5,730	5,698	6,592	5,630	5,702	22	29.352	+ 4,274
Lima	43,198	43,561	41,921	42,076	...	...	47,887	45,362	46,082	50,716	...	...	13	142,160	+ 14,602
Manaos Rs.	...	...	...	...	...	...	...	...	...	...	...	...	—	—	—
Manila $	169,000	167,000	168.000	172.750	...	...	236,612	231,585	211,368	207,792	...	...	13	650,745	+ 142,995
Monte Video	34,025	36,016	34,573	36,659	33,704	32,301	38,441	40,910	38,772	41,070	37,014	37,382	31	265,287	+ 26,949
Peruvian $	1101090	1189350	925,410	...	...	...	1057990	1009650	943,470	...	...	...	34	7,973,835	− 229,195
Para	23,315	24,060	22,198	24,848	24,745	...	23,800	24,515	23,248	26,022	25,342	...	21	122,927	+ 3,761
Port Elizabeth	...	...	...	...	4,028	...	...	...	...	...	5,576	...	—	—	—
Rangoon	5,438	5,361	5,662	5,955	5,885	...	6,188	6,373	5,694	7,533	6,217	...	17	25,817	+ 2,954
Toronto $	...	1068319	981.933	1113472	1065766	...	...	1106840	1015797	1083285	1051960	...	17	4,257,882	+ 28.392
Winnipeg $	...	334,642	298.899	307,289	...	...	...	390.539	371,162	384,937	...	...	13	1,146,638	+ 205,808

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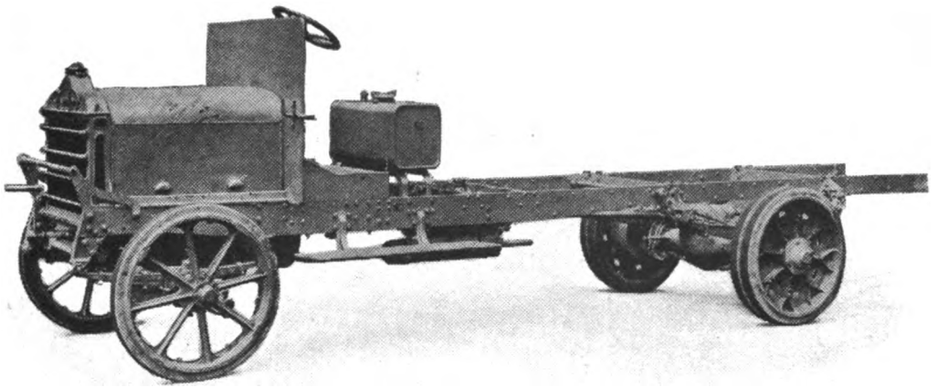

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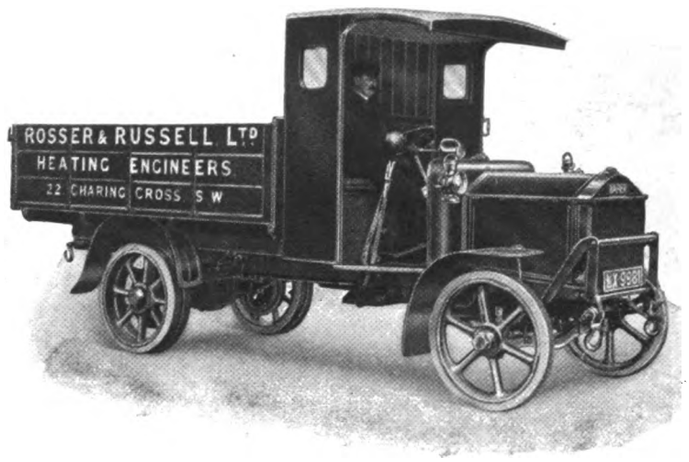

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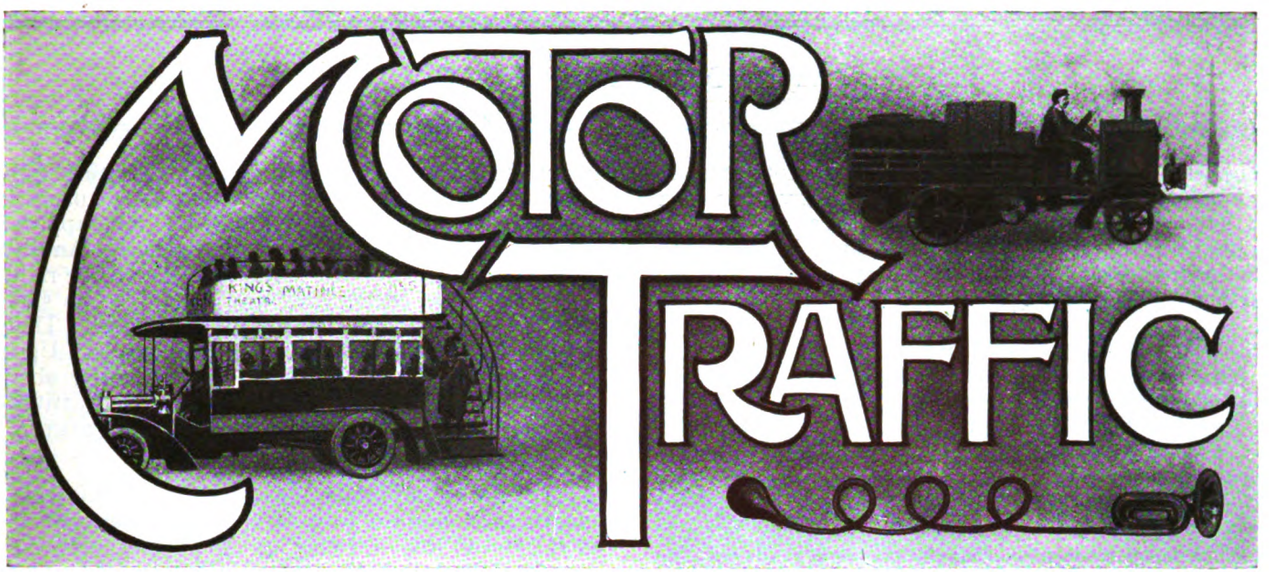

ROADS AND TRANSPORT EXHIBITION.

A forthcoming event of very special interest to all municipal officials, and particularly those interested in any way in the maintenance of roads or the provision of transport facilities, will be the Roads and Transport Congress and Exhibition which is to be held at the Agricultural Hall in November next. This event is a natural development of the road conferences held annually, with the exception of an enforced interval during the last two or three years, by the County Councils Association. The idea of coupling the conference or congress with an exhibition is not a new one. On previous occasions the annual conference has been accompanied by a show illustrative of road materials, their methods of application, and the machines used for applying them. It is only natural that when so many prominent officials come together for the mutual exchange of information and opinions, the opportunity should be given them of examining the new materials and methods submitted for their consideration. The importance of the forthcoming development is summed up by the introduction of the word "transport" into the title of the event. This is a recognition of the fact that the man who is interested in roads cannot take a detached or prejudiced view of the vehicles that use them. The roads exist for the purpose of traffic, therefore while to some extent the road surveyor may try to make traffic what he would like it to be, he must in the main take it exactly as it exists, and cater for it to the best of his ability. It is therefore very useful to him, when he comes to discuss road matters, to be given an easy opportunity of becoming familiar with the construction and the ubiquity of modern road vehicles. It is equally important that during discussions he should hear not only the views of surveyors, but equally the views of those who make and use road vehicles. Failing this, he is apt to regard the road that he has built too much as a work of art that ought to be protected from all rough usage, and the vehicle too much as a sort of Juggernaut which is deliberately devised to break up his precious highways. It must be candidly admitted that the fault is not all on one side. Vehicle interests for their part are more than a little inclined to resent the very slightest control imposed for the purpose of preventing roads from being unnecessarily damaged. By discussing road and road traffic problems from all conceivable points of view, we are likely to arrive all the quicker at a proper appreciation of the basic fact that roads and road vehicles are merely different parts of one entity, together constituting a road traffic system.

WIDENING SPHERE OF MUNICIPAL MOTORS.

It is, of course, impossible to say yet whether the Roads and Transport Exhibition will be well patronised in respect of vehicle exhibits. We sincerely hope that such will be the case, because we believe that it is in the interests of the motor industry that municipal officials should become familiar with its products and the personalities responsible for them. This makes for better mutual understanding and for the extended use of motors in municipal service. The whole trend of events is steadily making the sphere of the municipal motor wider. In all probability municipalities and County Councils will be required by the Government to organise large numbers of services into rural districts. It is certainly in the interests of the motor industry that this should be the case; and the industry should take the opportunity of showing the municipal official, who has a big potential influence on orders, how adaptable the modern motor chassis is to the reception of a great variety of types of bodies, each fitting it for some distinct purpose or group of purposes. Even if the chassis itself is not of the very latest type, various new forms of utility may often be effectively illustrated by showing it equipped with some more or less original form of body work. If the exhibition referred to contains a thoroughly representative collection of complete motor vehicles for various kinds of municipal and County Council use, its educative value will be immense, and its influence in promoting business will be widely felt.

THE PRESENT SCOPE OF THE ELECTRIC VEHICLE.

The paper which Mr. Ayton recently read before the British motor manufacturers on the subject of electric vehicles in commercial use constituted a very valuable addition to the literature of the subject. As a well-known advocate of this type of vehicle, Mr. Ayton might have been expected to show a certain amount of prejudice and to claim rather more than many people would be willing to concede. He avoided both these errors. In fact, upon the latter point, he emphasised the limited sphere or utility of the electric under existing conditions, and pointed out that it is really fitted to compete less with the petrol vehicle in the sphere which the latter already occupies than with the horse delivery van used in urban areas under

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MOTOR TRAFFIC

conditions such that the petrol vehicle has not succeeded in ousting it. His view may be expressed by saying that he looks at the broad question of mechanical *versus* animal transport, and that he is engaged in advocating the increased manufacture of a type of vehicle which may help to accelerate the victory of mechanical power.

ITS ADVANTAGES AND LIMITATIONS.

No sane man would contend that the electric vehicle has no merits other than those possessed equally or in a higher degree by the petrol vehicle. "Electrics" are admirably controllable in traffic; they are easy on tires on account of their steady pull, and they use no fuel while standing still on collection or delivery work. They are clean and of good appearance. Acceleration is steady, and not jerky; the vehicle starts automatically and without manual effort, but with complete certainty. It has advantages as regards the absence of fire risks. Its control is extremely simple. Its repair bill is small, and it is highly independent of extremely severe weather conditions. Its great demerit is, of course, its limited radius of action. To overcome this trouble, a very comprehensive organisation of charging stations all over the country is a necessary preliminary. Even then, charging must necessarily take time. A secondary drawback is its high price, but this, no doubt, is largely due to the fact that as yet the electric is not the subject of quantity production taken to the highest possible point. Then again, it is apt to be rather heavy, and its speed is not equal to that of a petrol vehicle. So long, however, as we recognise its special sphere of utility for town work, these latter points are not of the utmost importance. A vehicle that is really flexible, easily controlled, and possesses high power of acceleration, can often average better in traffic than one inferior in these points but superior as regards maximum speed capability.

LIGHTS ON MOTOR VEHICLES.

During the past years we have been using motor vehicles under a series of temporary regulations. A number of war-time orders have applied to the lighting of motor vehicles. Some restrictions have, of course, now been removed, but other regulations are destined to become more or less permanent either in their present or in a modified form. There are, for example, regulations as to the positions which vehicle lamps must occupy. The side lamps must be on the extreme left and right of the vehicle so as to show its width. This is really a common-sense precaution, because the lamps themselves, when lighted, make it difficult for an approaching driver to see the vehicle behind them on a dark night. Realising the purpose of the regulation, which is obviously to avoid anything in the nature of a head-on collision at night, we see that the regulation cannot be effective if the body or load extends any material distance sideways beyond the lamps. It is not always an easy matter to arrange that the lamps shall not be misleading as to the width of the vehicle, particularly if we take the case of a steam lorry, having lamps placed on either side near the forward end of a boiler. It is evident that lamp brackets of great length would be needed to indicate the full width of, let us say, a big pantechnicon body. Lamps so placed as to do this would probably suffer from frequent damage, especially when driving in dense traffic. Despite this difficulty, the owner of the vehicle may expect before long to find himself the subject of attention by the police unless he manages to get his lamps so far apart as to indicate very approximately the maximum width of his vehicle. Another minor point is that the rear lamp must be on the right-hand side of the centre line, and should be as short a distance as possible inside the off rear wheel. There is no great difficulty in conforming to this rule. Up to the present the authorities have not worried about trifling breaches of the regulations, but their attitude is likely to become a great deal stiffer in the future.

SLOUGH MOTOR DEPOT INQUIRY.

The Joint Committee of Lords and Commons appointed to inquire into the establishment of the Central Motor Repair Depot at Slough began to hold the public inquiry on May 3, and continued its sittings till Wednesday, June 4, when the inquiry closed, and the Committee decided to consider its report in private. During the course of the inquiry many witnesses were examined, and much interesting evidence was submitted, but the chief protagonists were Lord Inverforth on the one side and Lord Desborough on the other. Lord Inverforth admitted that there had been mistakes made both at the inception of the scheme and during the course of modification consequent upon the signing of the armistice, but contended that the repair depot was both economical and necessary, and that the site and structure were well chosen and properly designed. On the contrary, Lord Desborough argued against the scheme on the following grounds:—Error of policy underlying the principle of establishing a single central depot. Absence of any need for the depot either as a war measure or for post-war purposes. Ill-defined purpose of the scheme and the persistence of the Government in proceeding with it. Unsuitability of the water-logged site. Extravagant cost and size of the works. Unnecessary diversion of labour. Conditions of employment of contractors.

Motor manufacturers await with great interest the judgment of the Committee and the issue of its report.

THE "SAFETY FIRST" MOVEMENT.

Representatives from local authorities, technical institutes, railway companies, omnibus companies, and industrial and insurance bodies attended the annual meeting of the "Safety First" Council, held in Westminster Guildhall, under the chairmanship of Mr. Joynson Hicks, M.P., assisted by Mr. H. E. Blain and Mr. A. P. Johnson, honorary secretaries. The Council was able to report satisfactory results of their action in regard to street improvement and the lighting of omnibus and tramway routes in several localities. A "Freedom from Accidents" competition had been established for drivers. An essay competition for school children had also been arranged. Reports from local propaganda meetings gave encouraging signs that the public interest in the subject of "safety" was being awakened to a high degree. The Publicity Committee reported that the City Corporation and twenty-eight local authorities in and around London had consented to extensive display of posters.

Recently the Council has issued two posters of great value. In the larger poster instructions are given to motor drivers, with vivid illustrations, showing how dangerous are practices which the men are apt to regard as of little consequence. On the smaller poster is displayed a picture so real and so true to horrible fact as to send a thrill through the heart of the most stoical. A bright young girl has gleefully escaped the hold of the nurse, shooting off on her scooter, and running unconsciously right in front of a huge motor wagon. The wild despair of the nurse, the swift promptitude of the constable, and the horror of the driver are pictured with fidelity, while the innocent joy of the child, wholly unconscious of its terrible situation, adds poignancy to the scene. No more powerful "safety first" warning has yet been issued, for everyone who looks at it realises how easily such an accident may happen.

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THE FRENCH MOTOR TRANSPORT CORPS.

By Robert Altermann.*

France possessed before the war about 80,000 touring cars but few lorries. To encourage the construction and use of commercial vehicles the Government organised annual races, of which full reports were regularly published. The programmes of these races were designed to develop certain definite types in order to approximate, as far as possible, to the military lorry. As the result of these races, a certain number of vehicles were passed by the Government for the award of bonuses. Any purchaser of these lorries undertaking to keep them in good running order, and to hold the specified number of spare parts in his possession, became eligible for four successive bonuses, the first at the time of buying and three later on to defray the cost of upkeep if the vehicle was found on inspection to be in a satisfactory condition. At the same time the manufacturer, whose trade naturally benefited through winning the bonuses, undertook to keep in stock a further number of spare parts to be issued for each accepted vehicle on mobilisation.

In the first fortnight of January of every year a census of all motor vehicles was taken, owners being required to make the necessary depositions at the centres of local government. From these a register was compiled, and the necessary extracts forwarded to Army Corps Headquarters. Lorries and commercial vehicles that had not passed the Government test underwent classification as to their condition and adaptability for military requirements; this information was also passed on to the army authorities. They in their turn compared these figures with actual needs, and made out definite requisition lists, individual owners being warned that in the event of mobilisation they would be required to bring the selected vehicles before a committee of requisition to be held at a specified place.

As a general rule, touring cars were not required by the annual classification committee, for their number was considerably in excess of mobilisation needs. It was found sufficient to arrange for the purchase of a certain number of cars voluntarily offered upon certain conditions by their owners. The latter undertook to put these cars at the service of the Government for the annual periods of military training, each owner driving his own car. As a recompense for these loans, they would be called up in the event of mobilisation as drivers of the cars in the motor transport service. If the number of touring cars thus offered in any area was found to be insufficient, the remainder were brought before the classification committee, the best chosen, and the owners informed that these would be required upon mobilisation.

The *personnel* required for the motor transport service were obtained from the drivers and other workmen due to join the baggage train of their area. Drivers of cars that were requisitioned who happened to belong to any other arm were attached for duty with the motor transport service. Officers required to complete the establishment were selected according to their professional and technical abilities from the other arms, and transferred if they so desired. Training for this *personnel* was provided from 1913 onwards by the organisation of finishing schools. The first of these was at Vincennes, where a number of officers were put through courses.

MOBILISATION.

Mobilisation had been prepared by the fourth sub-division of the general staff (motor section), and took place on the lines already explained. Vehicles proceeded in groups to the mobilisation centre of their district. There they were received by the commandant, who took them over, enrolled the *personnel*, had all machines put in working order at an emergency workshop, and then led the convoy on the date fixed to an organisation centre. There were four of these centres, set up at Versailles, Rheims, Dijon, and Lyon, and here lorries of the same manufacture were formed into administrative sections, and despatched to the different armies together with the necessary number of cars for the use of the general staff.

The 1,049 omnibuses of the Compagnie Générale des Omnibus de Paris had been divided up into units, some for the transport of troops, others for the provision of fresh meat. Of these 192 were immediately despatched without alteration for the former object; 770 underwent certain prearranged modifications in the company's workshops, including replacement of windows by zinc screens, removal of seats and cushions, insertion of meat hooks, etc. In addition 87 omnibuses and 22 lorries were requisitioned for use as mobile workshops and travelling offices. The omnibuses were gathered together in their own depots, and despatched in administrative units direct to the mobilisation centre, the drivers being put as far as possible in charge of their own vehicles.

DEVELOPMENT DURING THE WAR.

The army's requirements for motors and vehicles of every kind steadily increased during the war. This increase was most noticeable in the number of lorries and motor ambulances. At the outset lorries had only been used in the transport of food and ammunition, and in 1914 this only amounted to an average of 18,000 tons a month; by 1915 it had risen to 300,000, by the end of 1916 to 750,000, and at the time of the armistice had reached 900,000 tons per month. During this expansion the lorries were put to an ever increasing number of uses, including the transport of fighting units; 460,000 men per month were carried in 1915, 750,000 at the end of 1916, and 900,000 at the time of the armistice. Other new services rendered were road-making, the transport of logs, and of telegraph sections.

Departure of Paris Omnibuses for the Front in August, 1914.

At the outbreak of war there were very few motor ambulances, only a small number of delivery vans having been converted to this purpose with the assistance of the first available material. This service was entirely reorganised and extended until it became possible to attach an ambulance section to every division. The number of sick and wounded that have been removed every month has been very considerable; for example, at the end of 1916 it amounted to 300,000, though of course each man may be counted several times on different journeys from field ambulances to hospitals and from hospitals to railheads. The artillery made more and more use of motors as their means of rapid transport; for example, motor guns, field pieces mounted on cars, armoured cars, tractors for heavy guns, and motor vehicles for ammunition supply. All these vehicles, however, like those of the air service, do not really belong to the motor transport corps.

The motor corps itself consisted of 8,500 vehicles in August, 1914 (6,000 lorries and 2,500 cars). At the end of 1915 this figure had reached 30,000 (18,000 lorries and 12,000 cars), by the end of 1916, 40,000 (25,000 lorries and 15,000 cars), and by the armistice it had risen to over 100,000 vehicles. It was easy to requisition almost all the cars required, while a third of the heavier vehicles were purchased in America, one-tenth in Italy, and the remainder in France.

This increase of material made necessary a fourfold increase of *personnel*, and in order that the number of officers required to command the new units should not cause too heavy a drain upon the other arms, N.C.O.'s and even soldiers who seemed from their profession or ability likely to qualify as officers, underwent a competitive examination every six weeks in their own army. Those who were accepted (three or four per army) were sent to a cadet school at Meaux, where on the completion of the course they were promoted sub-lieutenants in the motor corps. Soon afterwards

* M. R. Altermann's article has been specially translated for The Tramway and Railway World by permission of *Le Génie Civil*, in which the article was first published.

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Preparatory courses for the cadet school at Meaux were set up at Châlons, at Toul, and at Belfort.

The *personnel* employed by the motor corps amounted by the end of 1916 to 75,000, and must have risen to 100,000, exclusive of the artillery, by the time of the armistice.

TYPES OF VEHICLES EMPLOYED.

Cars are divided into the following classes:—Open cars, from 10 to 18 H.P., for commanding officers; open cars, from 12 to 20 H.P. (70 per cent. of the whole); closed cars, 16 to 24 H.P., for the staff (20 per cent.); and cars of 24 H.P. and over for the same use (10 per cent.).

The ordinary lorries with solid rubber tires are fitted with seats for twenty men. Their normal load varies from two to three and a half tons, averaging three tons. They are organised as sections of 17 or 18 lorries, including one travelling workshop and one trailer kitchen; each vehicle is in the charge of two men, and each section has an average loading capacity of 35 tons. Four sections under the command of a captain make up a group, and are able to carry one day's rations for an army corps, two echelons of field gun ammunition, two heavy batteries complete, the kits of a division, and a battalion of infantry. Several such groups are on the strength of every army, and in addition there are the G.H.Q. reserves.

The ordinary type of tender is of 12 to 16 H.P. They run on pneumatic tires, have seats for ten men, and a capacity for one and a half tons useful load.

The Paris omnibuses, of 30 H.P., are provided with special seating arrangement for the transport of troops. They are on solid tires, and can carry a load of two tons. A section is made up of ten omnibuses with a travelling workshop. A group will carry a battalion in the same way as a group of lorries, but with the advantage that it consists of only 40 vehicles instead of 70.

The majority of the Paris omnibuses, however, as we have already indicated, were employed for the transport of fresh meat. Their useful load is also two tons; seven or eight of these with a travelling workshop make up a section allotted to a division. In the case of a cavalry division only four omnibuses are included in the section. The omnibuses take the meat from the slaughter-houses to the divisional ration dump, where it is transferred to ration wagons belonging to the various units.

Ambulances are normally tenders of 12 to 20 H.P., fitted with pneumatic tires, and arranged inside for the reception of the wounded. Their load is about 16 cwt., and 20 vehicles, together with the workshop, make up a divisional field ambulance capable of dealing with 80 to 120 stretcher cases and 120 to 140 sitting up.

Interior of Omnibus Fitted for the Transport of Meat.

Tractors are lorries with four driving wheels which are able to get over bad ground; their principal function is to move guns. There are in addition tractors of a special type, with a capacity of 45 H.P. These are provided with caterpillars, worked by two driving wheels which cog into an endless chain of dented metal plates instead of acting directly upon the ground. The caterpillars were largely used in the Vosges for moving artillery into positions which could hardly have been attained by other methods; the tanks are provided with similar contrivances which had been thought of before the war in connection with agriculture.

ORGANISATION.

The motor service is under the control of a director; under him there is an officer in chief command of the service for each army.

Omnibuses Transformed into Supply Vans.

The director is known at G.H.Q. by the abbreviation D.S.A., the officer in command of the army as C.S.A. The D.S.A. has under his direct orders the following organisations:—(1) The base vehicle parks where new and rehabilitated material is received, and where new units are formed for despatch to the armies; (2) the sorting park, whither all damaged vehicles are returned by armies—here as many as possible are restored to a serviceable condition, the remainder being sent back to the manufacturers; (3) the central motor store, which obtains all accessories and spare parts required for the upkeep of vehicles in commission, and despatches them to the armies as need arises; (4) the cars required by G.H.Q., and the reserve transport groups (rather more than are required to supply two Army Corps), and all the base transport; (5) the base workshops for periodical inspection of army vehicles.

The C.S.A. controls (1) the staff cars and all the motor transport of his army, including corps and divisional staff cars, one section of the ration omnibuses, and one section of ambulances per division; (2) an army motor transport park where repairs can be carried out, and also a certain number of oil and petrol stores within his area.

The base vehicle parks are situated at Versailles and at Dijon; the former deals with all vehicles manufactured either in Paris or in America, the latter with those coming from Lyon or Italy, and also repairs the bicycles and motor cycles of all the armies (approximately a hundred cycles and four motor cycles daily). It issues to armies all special apparatus required by motorists. The sorting park is at Paris. Three-quarters of the broken-down vehicles received from the armies are put in order and returned to Versailles. The number of vehicles scrapped was not large—about 30 lorries and 50 cars per month. The central motor store has two branches, the first for objects such as tires, lamps, tools, etc., that are useful for all vehicles, the second for spare parts peculiar to individual types. On an average the store received 10,000 indents daily from the armies. It was served by a special postal arrangement necessitated by the frequent movement of units from one army to another. This only functions, however, from store to armies; from armies to store the ordinary post is employed. The base workshops attend to those vehicles requiring too lengthy overhauling for armies, and in the case of an advance they pick up and restore all derelict vehicles left behind. Each workshop specialises in one or two types, and carries out periodical inspections of all vehicles of those types.

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MOTOR TRAFFIC

The army motor transport park is under the command of a captain, and includes a section for the sorting of motor transport *personnel* and two or three park sections. An investigation committee examines all the unserviceable returns from units in order to find out what has been broken or worn out through lack of attention or accident, and what is of faulty manufacture, with a view to taking action against the maker. Park sections are repair shops, mobile, like the park itself, with the army to which it belongs. Their non-combatant *personnel* includes as a rule a hundred specialists divided among several shops: assembling and tuning up; machining; soldering, brazing, and forging; body repairing and painting. A section is set up as far as possible on the site of some requisitioned factory. It includes a certain number of movable hangars and machine tools that are on its establishment (three lathes, drilling machine, a die-stamping machine, two grindstones, and a dynamo for lighting, all worked by a small petrol engine of 12 H.P.). To one section in every army is attached a certain number of reserve motor omnibuses, which allow of the periodical relief of meat wagons, so that this important *matériel* may be regularly overhauled. In this way each section passes through the workshop in turn, its omnibuses being taken down and thoroughly overhauled by special gangs of workmen.

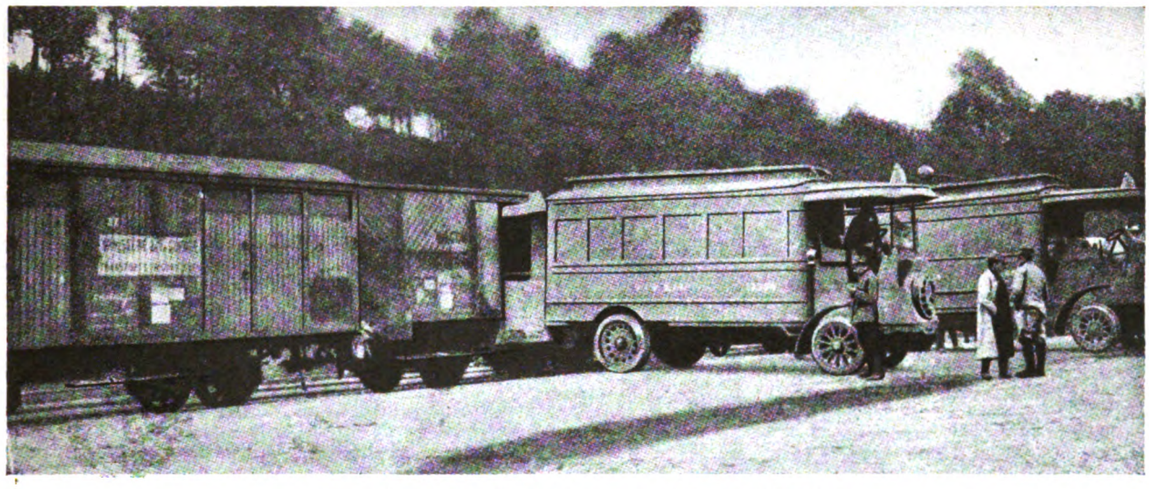
An army park moves as rarely as possible, so as not to interfere with the continuity of its work; it is considered that it should make a corresponding advance when the front has moved a distance of 100 to 150 kilometres. The transportation is effected by means of the motor transport section belonging to the army; an army park consisting of two sections will have about 120 tons to move, and this can be completed by instalments in less than eight days without interfering seriously with the work.

USE OF MOTOR TRANSPORT AT THE FRONT.

It will be interesting to refer to the regulations laid down for the employment of the various sections. For the best use to be made of the lorries it is essential that they should not be specialised; the greatest economy can only be obtained by using all lorries for every purpose. For the transport of troops the lorries are drawn up in a column at a spot on the road that has been chosen beforehand; the troops arrive in column of fours, each battalion halting by its allotted lorries. The companies are then taken to their own sections, and split up into squads according to the size of the lorries. Loading in this way is completed in twenty minutes. When some point of the front has to be supplied in a great hurry, as in the course of the battle of Verdun in 1916, experience showed that it was best to organise the road traffic like a railway. The route is reserved for the motor transport under the orders of G.O.C. lines of communication; uninterrupted circulation is then possible in both directions, and sections are established to facilitate policing and upkeep. A control committee arranges the traffic regulations, march tables, and points of loading and unloading, and divides up the available labour for effecting road repairs. The committee is in telephonic communication with all the officers in charge of sections, and these officers arrange for the setting up of all the traffic-signs required by day and night to prevent blocks; they also arrange when necessary for traffic which has to cross the road and deal with all stoppages. Speeds are thus regulated: lorries, 10 miles per hour; ambulances, 12 miles per hour; cars, 20 miles per hour. A special service provided by the nearest army park arranges for breakdowns—an average of 1 per cent. of the vehicles. As a rule the loading points will be railway stations. Here there will be several loading sheds, one being filled by arrivals while the motor transport is clearing another; each shed is capable of accommodating two sections of lorries at the same time. With a sufficient number of loaders, 600 men per refilling point, 80 tons (a full load for two sections) can be handled in two hours, making about 1,000 tons per day. With such arrangements the average number of vehicles passing a given point in each direction will be about five per minute.

Taking a fortnight, say from February 22 to March 7, 1916, during the battle of Verdun there were 600 lorries covering 85 miles daily, a total of 750,000 miles, or three times the distance round the earth. At the same time troop-carrying lorries covered more than 1,000,000 miles. In March, 1916, more than 300,000 men were carried over this route.

Such were the general lines of the organisation of the motor service, which has probably been of no less importance to the armies than the air force; it has fed them, and enabled them to move rapidly from one critical point to another as required in regions where the railways have been completely destroyed. The motor service should therefore not be forgotten among the other arms, old and new, which France and her Allies developed from day to day until the hour of victory.



Paris Motor Omnibuses in Army Transport Service.

NATIONAL HAULAGE ASSOCIATION.

TRANSPORT SCHEME TO EMPLOY EX-SERVICE MEN.

At the first annual meeting of the Ex-Officers' Employment Bureau, Captain Redgrave outlined a scheme called the National Haulage Association, which had, he said, the sympathy of the Ministries of Munitions and of Supplies. They proposed in a few weeks to start a large haulage company which would employ none but ex-service men. They hoped to have between 400 and 500 good jobs for officers, and 4,000 appointments for ex-service men. When the scheme was first suggested it was very difficult to get business people to associate themselves with it, because they said it could not be run commercially if none but ex-service men were employed. But there was a shortage of national transport to-day, and no big company could undertake haulage for any large new contract.

BRITISH SCIENTIFIC PRODUCTS EXHIBITION.

The forthcoming exhibition of British Scientific Products promises to be of even greater interest than the very successful show of last summer. All the available space at the Central Hall, Westminster, where the exhibition will be held, has now been allotted, and the organising committee announce that they can entertain no further applications. The exhibition will be open to the public from July 3 to August 5, 1919. Its scope will be more extensive than was possible at last year's display, when war conditions made it necessary to withhold from public view much of the scientific and technical work carried on in Great Britain. Striking testimony will be furnished of the enterprise of British manufacturers, and the uses they have made of science and invention in new industries and the development of old.

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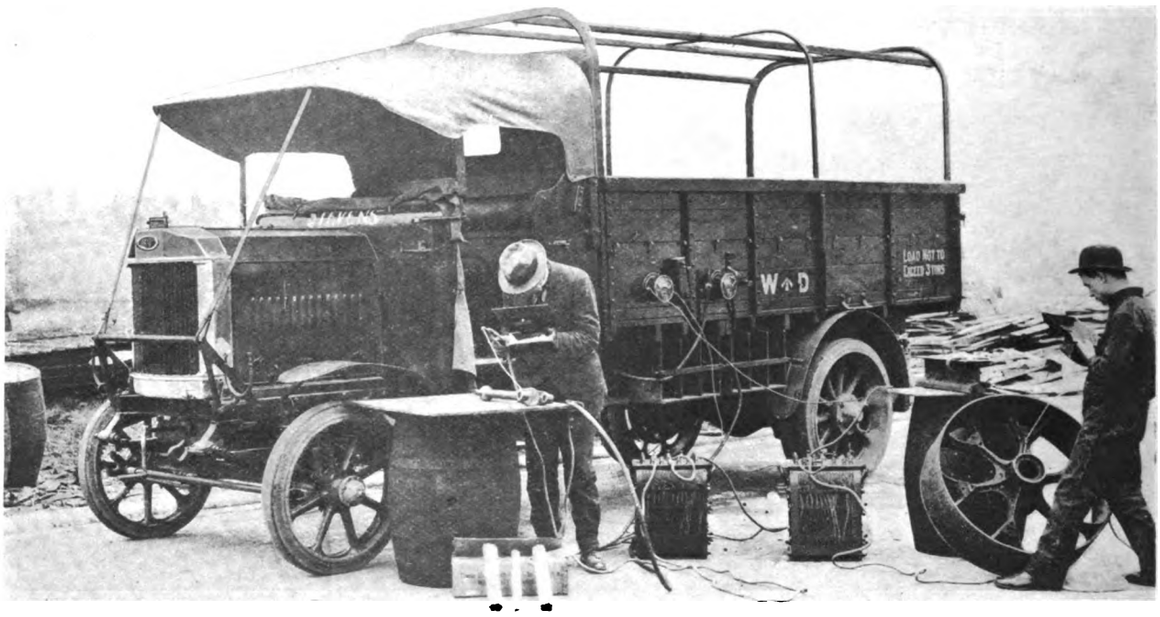
MOTOR TRAFFIC

"STEVENS" MOBILE ELECTRIC WELDING PLANT.

As briefly noted in our issue of May 15, an interesting demonstration of the "Stevens" machine as a mobile electric welding plant was given by Stevens Petrol-Electric Vehicles, Limited, of which company Mr. W. A Stevens is managing director. The demonstration took place at the works of Messrs. Dennis Brothers, at Guildford, and covered a wide variety of operations, all of which were carried out very successfully and with remarkable rapidity. As is now generally recognised, the superiority of electric welding, when compared with other methods, is due to the fact that the heat generated by the electric arc is extremely local, thereby resulting in a much smaller area of disturbance, and also by reason of the elimination of the necessity for any pre-heating of the work to be welded.

For the demonstration a standard 3-ton "Stevens" petrol-electric War Office subvention type vehicle was used. The system of welding was the Quasi-Arc process, which in normal working calls for a terminal pressure of not less than 90 volts nor more than 115 volts. As a matter of fact, throughout the whole course of this demonstration a steady pressure of about 105 volts was maintained, and much of the success of the various operations was due to the evenness of the pressure. The accompanying illustration shows the machine at work supplying current to two separate welding outfits working simultaneously. In each case the company's B3 resistance is being used to adjust the current for the particular size of electrode in use, and the nature of the work being carried out. As the high pressure specified is only required intermittently, in order to overcome the resistance offered by the unvolatilised slag with which the electrodes are covered, the Quasi-Arc Company has recently designed and patented a reactance coil by means of which it has been found possible to work satisfactorily on a direct current supply of 60 volts. The importance of this development can be appreciated by the fact that with one of the "Stevens" standard lorries three welding equipments can be run at the same time, each working independently. At the actual demonstration, with the new reactance coil—which in practice boosts up the voltage as required whilst the welding is in progress—the generator of the vehicle was set for an output at 60 volts, and a perfectly steady flow of current was maintained at this voltage, although different sizes of electrodes were used without any attention from the driver of the vehicle whatever. As the vehicle can carry a large amount of tackle and tools, in addition to the three welding equipments, it will be seen that a wide field of usefulness in the traction and general engineering industry is open to the "Stevens" mobile welding plant, especially where a suitable supply of current is not otherwise obtainable.



LONDON OMNIBUSES AND ROADS.

A movement has been started among the local authorities of London for obtaining payment of a contribution towards road maintenance from the omnibus companies.

Westminster Corporation were the first to put forward the suggestion, following a letter from the London General Company suggesting the restoration of a service that had been taken off during the war. The reply of the Works Committee set forth the inadequacy of existing services, the discomfort caused by the carrying inside of five standing passengers, and the insufficiency of the inside seating for eight persons on each side. Finally, the Committee suggested that the company should pay a nominal sum in relief of rates in respect of maintenance of the roadways. To this suggestion the company replied that they could not entertain it, as the amount already paid in the form of petrol duty to the Road Board is a very heavy charge on their revenue.

Lambeth Council have adopted a similar suggestion after a discussion which was taken part in by Councillor J. Mitchell, the Comptroller of the Underground and Omnibus Group, who maintained that the undertaking was already sufficiently taxed in that the petrol duty was levied for the purpose of road maintenance.

Camberwell Council have passed a resolution urging the Government to appoint a Commission to inquire into the increased fares and also the working and management of the London General Company "with a view to providing out of their revenue a direct contribution towards the upkeep of the roads, and to limit arbitrary and unnecessary increases of fares."

Meanwhile none of the criticising Councils have given the omnibus undertakings credit for the fact that their fare increases are not so great as those of the County Council Tramways, and that it is possible by using an omnibus to save a penny on the charges made by the tramways.

MOTOR CARS FROM AMERICA.

In the House of Commons on May 26, Sir A. Geddes informed Colonel Herbert that in April British firms were notified that until September 1 they will be allowed to import American motor cars to the extent of 50 per cent. of their 1913 imports divided into twelve monthly instalments. Colonel Herbert inquired whether, in view of the demands of business in this country, it was not possible to allow a larger importation Sir Auckland Geddes replied, "The ration was fixed by the Imports Consultative Council. I do not propose to alter the decision."

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MOTOR TRAFFIC

ROADS AND TRANSPORT EXHIBITION.

The County Councils Association has decided to organise a Roads and Transport Congress and Exhibition at the Royal Agricultural Hall, London, in November of this year. The arrangements will to a large extent follow the lines of the successful Roads Congress and Exhibition organised by the association in 1915, but in view of the important developments in regard to transport, it has been decided on the forthcoming occasion to pay special attention also to this branch of the road problem. The organising secretary of the congress is Mr. S. M. Johnson, the secretary of the County Councils Association, and the exhibition will be under the management of Mr. A. F. May, the managing director of the Municipal Agency, Limited, 13, Victoria Street, S.W.

Arrangements are being made with a view to securing the attendance of representatives of the home Government and the Governments of all the British Dominions, while invitations are also being extended to the various local authorities and to all professional and commercial bodies and societies connected with the administration and user of the roads.

MODERN STREET CLEANSING METHODS.

REPORT OF A GLASGOW CORPORATION DEPUTATION.

In view of the importance of the cleansing department being provided with the most up-to-date haulage plant and appliances for cleansing purposes, Glasgow Corporation appointed a deputation to inspect the haulage plant and appliances in operation in London, Birmingham, and Sheffield, and as a result the cleansing committee propose the purchase of—

(a) Eight additional 2-ton electric vehicles, the cost of which, excluding the bodies, which will be built at the department workshops, is estimated at £8,000;

(b) Five motor street-sweeping machines at £525 each; and

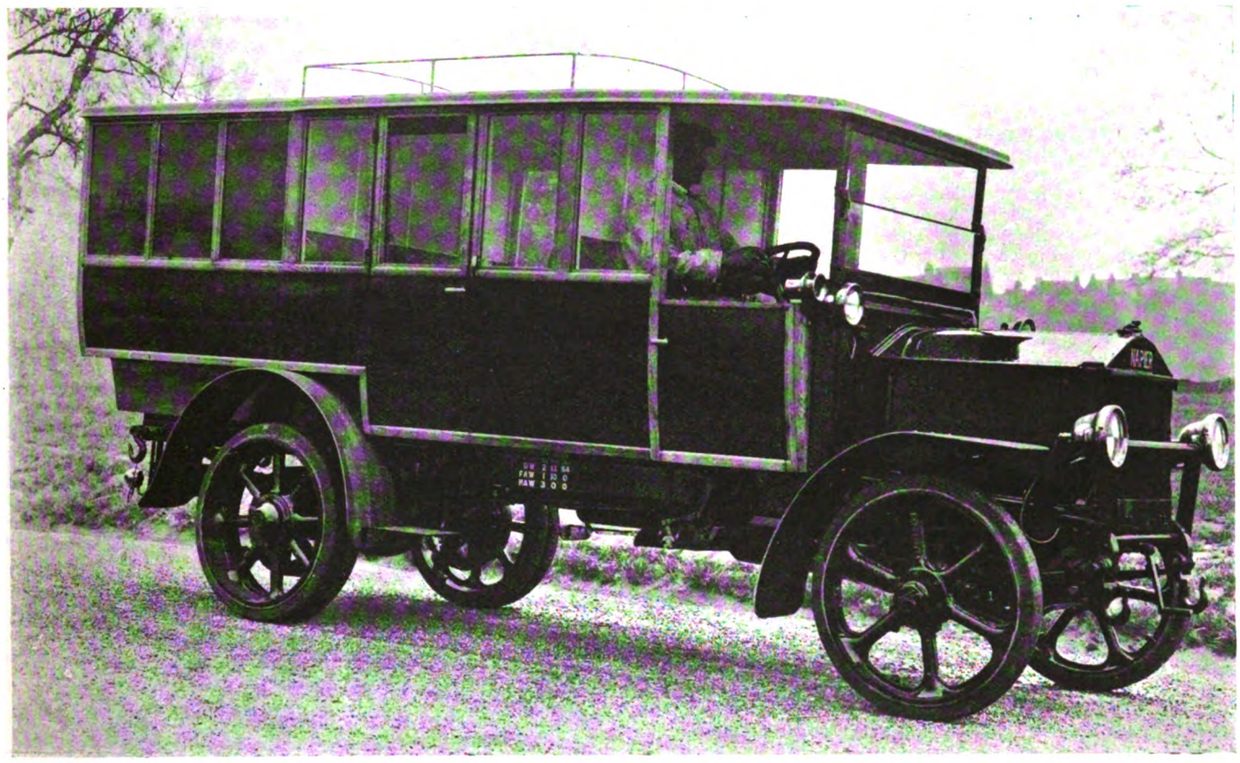
(c) One Pioneer sweeping and loading machine at £360.

Subjoined is the report of the deputation:—

The deputation had long interviews with the makers of electric refuse removal vehicles. There has been no material alteration so far in the type of vehicles, except that the later types have a loading line which is a little lower than the machines at present in use. The latter have been very successful and economical, and the committee recommend the purchase of eight additional 2-ton electric vehicles to cope with the work during the coming winter. By doing so, the purchase of sixteen additional horses will be rendered unnecessary.

When interviewing the representatives of the Edison Accumulator Company, the question of the non-delivery of the two 3½-ton vehicles, which had been on order since July last year, was discussed. There is still no absolute guarantee as to when these would be delivered, and it was suggested that two 2-tonners at the same price as those last delivered should be substituted in lieu thereof. The deputation recommend that this arrangement be carried out. The probable cost of the eight wagons already referred to, excluding the bodies, which will be built at the department's workshops, is £8,000.

The works of the Lacre Motor Company at Letchworth were visited and an inspection made of their new type of motor sweeping machine. The machine, which had been hurriedly completed in view of the inspection, gave a demonstration on the road outside the works, where it performed satisfactorily. The machine has been specially made for the purpose of street sweeping, and the designer has corrected the mistakes of the past. It is lightly built,



A Napier Business Vehicle of a Novel Pattern.

NAPIER BUSINESS VEHICLE.

The accompanying photograph shows a recent type of a Napier business vehicle, fitted with rather a novel type of body. This body has been built specially for Mr. Lionel de Rothschild, and is composed of three compartments, one for the driver, one for servants, and the third for the accommodation of luggage. The vehicle has also been constructed for station work and for shooting parties, when it would have to traverse rough surfaces, requiring a chassis of particular strength and flexibility. The Napier has been chosen by Mr. Lionel de Rothschild because of its wonderful record during the war, and the satisfaction he has received from the six-cylinder Napiers he has purchased from the company.

OVER £2,000 FOR A SECOND-HAND CHARS-A-BANC.—At Elland, in Yorkshire, on May 29, a Leyland chassis, fitted with an ordinary 28-seated chars-a-banc body, fetched a sum of no less than 2,170 guineas. The chassis price of this identical machine when it left the works in February last was £945.

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MOTOR TRAFFIC

and there is therefore every reason to expect a considerable increase in the mileage to the gallon of petrol. The designer informed the deputation that there were 200 less parts in the new machine as compared with the former production.

Attention has been paid to rendering the machine easy of inspection, and for the removal of parts for any necessary repairs.

An important new feature of the machine is that it will sweep a width of 6 ft. 6 in., as compared with 5 ft. 3 in. by the present Lacre sweepers. The price of the new type of vehicle is £525.

A discussion took place with the representatives of the firm regarding the substitution in part payment of the machines owned by the department of this company's make, which have been in use for about four years. The firm agreed to take back these old machines in part-payment for any of the new types which may be ordered. There are five old machines. The deputation recommend the purchase of five new machines—one old machine being accepted in part-payment of each new one ordered.

The surveyor of St. Marylebone Borough Council was good enough to give the deputation a demonstration of the street gully cleaner made by the Straker-Squire Company, Limited, the representatives of the company being present. The machine performed the work satisfactorily, but the silt in the gullies had to be constantly stirred by an attendant and water added from time to time to keep it in a liquid state. The addition of the water for the purpose referred to, and also for filling the gulley after it had been cleaned, necessitated the presence of a water-cart. A further weakness is that the gullies, being completely emptied of their contents direct into the tank a considerable quantity of water, which had to be conveyed to the depot, where additional labour and time is incurred in draining off the liquid. The effect of these services obviously runs up the cost of the work. Another feature which was present here—and favourable to the machine as against manual labour for this work—was the depth and area of the gullies. These were very large, and not at all of the same type to be found in Glasgow, where they are very small and not so suitable for economical work by mechanical means. On the score of cost, however, the deputation find that the work is much more economically overtaken by the present method. The deputation therefore do not recommend the introduction of this machine for gully emptying in Glasgow. It should be borne in mind that the apparently insanitary effect of the Glasgow method in leaving the contents of the gullies lying on the street opposite the grating until the water drains off is greatly minimised by the fact that almost the whole of this class of work is executed either during the night or in the early morning.

A demonstration was also given of a street washing machine made by the same firm. The method here was to flush the surface of the street with water under pressure from the machine, with the addition of rubber "squeegees" to remove the loosened grit from the surface of the thoroughfare. The deputation were not satisfied that the machine had done its work effectively, and were convinced that the condition of the streets in Glasgow would tend to give more unsatisfactory results than those witnessed by the deputation. Accordingly, the acquisition of a machine of this description is not recommended.

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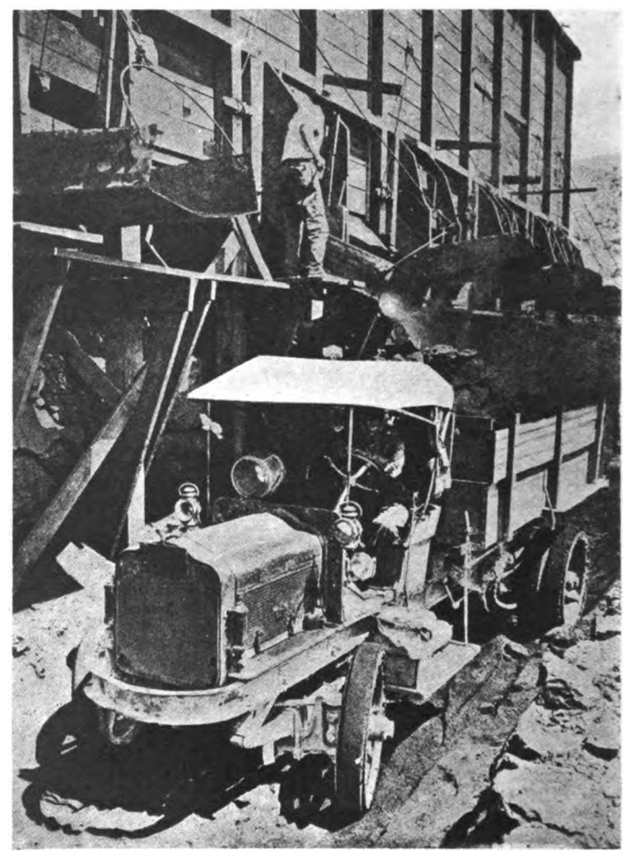
The chief road surveyor of Birmingham arranged for a demonstration of the "Pioneer" sweeping and loading machine on a street which had been specially left uncleansed for the purpose. The test was an exceedingly severe one, the crop of dirt upon the surface of the roadway being abnormal. The machine performed its work satisfactorily. It was highly spoken of by the officials in charge, and reassuring replies were given to questions by the deputation as to number of days at work per annum and repairs. The machine can be attached by a draw-bar to a wagon of any capacity, but possessing sufficient power to maintain the travelling speed of the whole equipment—wagon and "Pioneer"—at a rate of about five miles per hour. It consists of a strong frame containing a brush fitted at the extreme rear. The dirt swept by the brush is taken up by two helical scrolls working in opposite directions, which pass the refuse towards the centre of the machine and load it at the boot of the elevator, from which it is taken up by specially constructed buckets on endless chains to the elevator and deposited in the wagon.

The power to drive the brush and elevator is derived from two sprocket wheels on the main axle, both of which are fitted with throw-out gear. One sprocket drives the brush of the machine and the other the elevator, from the lower spindle of which the power is obtained for driving the scroll axle.

The deputation are satisfied that considerable economy can be effected in loading the street sweepings by such a machine, and recommend that one might be purchased in the meantime. The probable cost is about £360. This obviously does not refer to the wagon, which can be of general use, and it is proposed in the first trials of the machine to utilise one of the petrol motor wagons at present owned by the department.

NEVADA MINE MOTOR SERVICE.

About 17 miles from Las Vegas, Nevada, U.S.A., large deposits of invaluable manganese ore were struck last year, but transport of the ore to the nearest railway line seemed to present almost insurmountable difficulties. Construction of a railway, even if it had been feasible in ordinary times, would have been too costly, and in war time was a simple impossibility. At this juncture the management of the mines hit upon the happy expedient of using motor trucks for transporting the ore, and the adventure was a great success. Great 5-ton White motor trucks were employed experimentally at first, and latterly a fleet of twelve, with trailers, was kept constantly in service day and night, the motors being equipped with searchlights for the night work. At the mine end giant overhead hoppers, such as are commonly used by contractors in excavation work, were used, and fitted with chutes by means of which the ore was loaded by gravity into the trucks' bodies and trailers. One of the hoppers and a truck in the act of being loaded are shown in the accompanying illustration, for which we are indebted to the *Commercial Vehicle*.



Nevada Mine Motor Service.

THE NEW OMNIBUS FOR LONDON.

In the House of Commons on May 20, Mr. J. D. Gilbert asked the Home Secretary if the Chief Commissioner of Police is requiring a new type and standard of omnibus for the Metropolitan area before he will license same; and in what manner the new standard varies from existing types, licensed as to weight, build, passenger-carrying capacity, and other important features? Sir H. Greenwood, in reply, stated that the Commissioner had urged the desirability of designing a lighter type of omnibus, or alternatively of improving the springing, but did not suggest any variation as to existing dimensions or as to the number of passengers.

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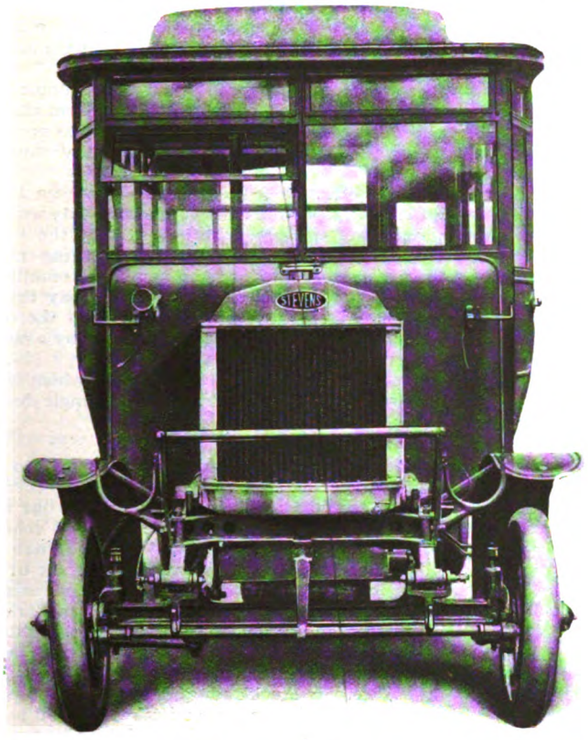
MOTOR TRAFFIC

STEVENS PETROL-ELECTRIC OMNIBUSES AT WALSALL.

The single-deck omnibus illustrated on this page is one of four which are being supplied by Stevens Petrol-Electric Vehicles, Limited, of 82, Victoria Street, Westminster, to the order of the



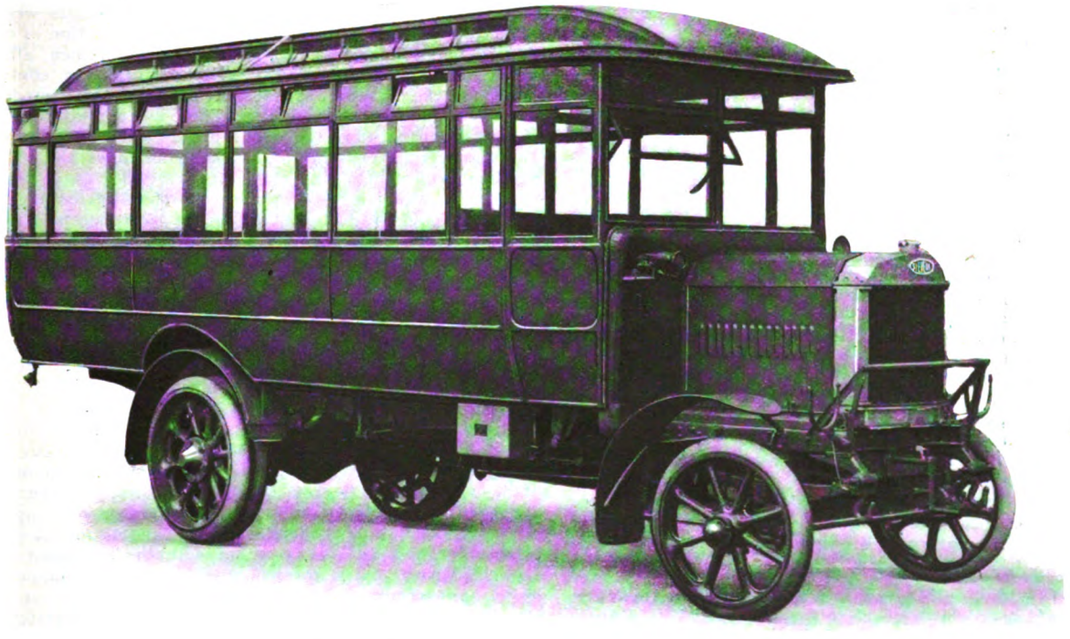
Walsall Corporation. The chassis is the Stevens "A" subsidy type, which was fully described in THE TRAMWAY AND RAILWAY WORLD for January 16 last, and is exactly similar to those which have been delivered in large numbers to the War Department. Owing to the extreme flexibility of the electric transmission, and the remarkable simplicity of the control, these machines are specially suitable for passenger work, and the two omnibuses already in service have created a very favourable impression both with the travelling public and the officials at Walsall.

The single-deck body was built by Christopher Dodson, Limited, of Cobbold Road, Willesden Green, N.W., and is their standard type single-deck. As will be seen from the illustration, it is of handsome appearance, while the clerestory roof gives ample ventilation as well as more headroom in the interior. There are seats for 26 passengers in the inside compartment, arranged on thirteen cross seats, and three on the driver's seat, giving a seating capacity for 29 passengers and the driver. The front of the body is fully enclosed, the entrance to the interior being at the side of the rear end. The inside seats have special flexible backs, the backboard being carried on a flexible steel plate, giving comfort in riding and at the same time reducing considerably the thickness of the backs, and so effecting economy of space in the length of the body. A feature worthy of notice is the method of fixing the body to the chassis. This is done by means of the builders' patent crossbars, which also support the side of the body laterally, and thus prevent any tendency to sag. This type of body has now been standardised by Messrs. Dodson's. The C.A.V electric lighting equipment gives ample illumination for the interior as well as for the head and tail lights.

KEMPTON PARK AND SLOUGH.

During the past few weeks vehicles from Kempton Park Racecourse have been included for sale at the auctions held by order of the Disposal Board of the Ministry of Munitions. A large number requiring repairs have been towed to the depot at Slough to undergo renovation prior to sale. For several weeks in May the Parliamentary Committee appointed to investigate the circumstances under which the War Office started the Slough scheme have held sittings, at which evidence was given on behalf of the War Department, and also of the motor manufacturers' offer in regard to repairing vehicles. From an answer to a question put in the House of Commons, it appears that at the date of the Armistice there were 16,931 vehicles at Kempton Park, and early in May the number of derelicts had been reduced to 13,177.

PRICE OF AN AMBULANCE CAR.—At a recent sale of war motor vehicles a 16-20 H.P. ambulance, presented to the Royal Navy by the United Province of India War Fund, realised 210 guineas.



Stevens Petrol-Electric Omnibus—Walsall Corporation Tramways.

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MOTOR TRAFFIC

LONDON TRAFFIC CONGESTION.

PARLIAMENTARY COMMITTEE APPOINTED BY GOVERNMENT.

Early in May the congestion of London passenger traffic, combined with the increase in fares all round, had caused such a ferment in the public mind that the call for some remedy became urgent. London Members of Parliament formed themselves into a Committee of Inquiry, and, as reported in our issue of May 15, heard evidence from Mr. Pick, commercial manager of the London General Omnibus Company, on May 5, and appointed a deputation of their number to approach the Board of Trade and the Local Government Board, urging the Government to take steps to mitigate the bad conditions existing throughout the whole metropolitan area.

EVIDENCE OF LONDON TRAFFIC MANAGERS.

Continuing their investigations on May 12, the committee of London M.P.'s took evidence volunteered by representatives of the London County Council Tramways and the Metropolitan Railway at the committee's invitation. In reply to questions, Mr. Squires, chairman of the London County Council Highways Committee, stated that the number of passengers carried on the Council's cars last year was over 636 millions, an increase of 224 millions over the total for the year 1908-9. In 1913-14 the working expenses were 6½d. per car-mile, and for 1919-20 they were estimated at 1s. 4d. per car-mile.

In a written statement, Mr. A. L. C. Fell, general manager of the London County Council Tramways Department, dealt with increased fares and overcrowding. The average increase on fares, as between 1913-14 and 1918-19 was 30 per cent., which compared favourably with the 50 per cent. addition made on railway fares. The main causes of overcrowding were increase in the number of passengers travelling and reduction in the number of cars available. Replying to Sir William Bull, Mr. Fell said that, by running omnibuses as the Council desired to do, they would be able to charge a cheaper through fare. In answer to Mr. Hopkins, Mr. Fell stated that approximately one-third of the increased cost per car-mile was due to labour.

Mr. R. H. Selby, general manager of the Metropolitan Railway, also gave evidence. As quickly as possible the service on the Metropolitan lines was being accelerated. In their new experimental train there would be five doors to a carriage, so that the passengers would be able to "unload themselves instantly," The new cars would seat 58 passengers. Mr. Selby stated, however, that until they knew the policy of the Government in regard to railways, it was considered imprudent to place large orders for new rolling stock.

LONDON COUNTY COUNCIL HIGHWAYS COMMITTEE EXAMINED.

During the week following the movement gathered force, agitation being specially directed against the increased fares charged on tramcars and omnibuses. Again, on May 22, South London M.P.'s invited the Highways Committee of the London County Council to meet them at the House of Commons, in order that the question of fares might be discussed. In a written statement Mr. Squires, chairman of the Highways Committee, stated the case for the Council. In framing the new fares, he said, the Council had limited the increases to the absolute necessities of the situation. In order that the tramways should pay their way, it would be necessary to raise over £1,000,000 more revenue. Even the increased workmen's fares would entail a loss of £105,000 per annum. It had been suggested that in most cases penny fares had been doubled, and that in some cases 2d. was charged for a distance of three-quarters of a mile. The answer to this was that the average distance now offered for 1d. is 1·48 miles against the previous distance of 1·8 miles. It should also be pointed out that only one-fourth of the passengers paying penny fares are affected by the recent changes. Mr. Squires contended that the tram fares were lower than those charged by the omnibus companies. The sole object of revising the fares had been to balance revenue with expenditure, and so prevent the L.C.C. tramway undertaking from becoming a charge on the rates.

Sharp criticism followed Mr. Squires' statement, Mr. J. D. Gilbert and Mr. Lane Mitchell giving instances justifying serious complaint. Mr. Fell replied that the stages had been very unequal, and that in the past many passengers had got cheaper fares than they were entitled to. At the close of the proceedings, Mr. Squires asked for a little patience on the part of the public.

DEPUTATION TO PRESIDENT OF THE BOARD OF TRADE.

Sir Auckland Geddes, on May 23, met the deputation appointed at the meeting of London M.P.'s held on May 12. Mr. J. D. Gilbert explained that London Members were being assailed by their constituents over the crowding of tubes, omnibuses, and tramcars, and the increased fares. Overcrowding had been further increased by the closing of stations, which threw more work on the tubes, tramways, and omnibuses, while the increase in season ticket rates was a serious item in the budgets of thousands of families.

In pre-war times the railway companies invited people to live in the suburbs, and the increase on "seasons" was extremely hard in those cases. They had interviewed representatives of the traffic combine and the cab interests. The explanation given was that they were unable to obtain supplies of material for repairs and new rolling stock in order to increase the services. The deputation urged that the Government should allow the import of repair parts in much greater quantity than now, and also to appoint a Select Committee to consider the question of London traffic.

Mr. Higham urged that the Government should give immediate consideration to the appointment of a permanent Commission, similar to the Public Service Commission in America, to regulate fares and see that a satisfactory service was constantly supplied to the public.

Mr. Clement Edwards, referring to the increase in season ticket prices, declared that it was a monstrous thing to penalise City workers by what was a purely war measure. He added that the traffic combine had refused an offer made by the War Office to bring chassis from France for the purpose of increasing the number of omnibuses on the London roads. The Government had a right to say that as a condition of the licence which the combine held from the community they should do something to meet the demand by availing themselves of the offer which had been made.

Major Archer-Shee said that there were 2,100 chassis which could be released as a temporary expedient, and rigged up as single-decked omnibuses.

SIR AUCKLAND GEDDES' REPLY.

Sir Auckland Geddes, in replying, said with reference to the statement that repairs were being held up because spare parts could not be imported, it was true that licences were required, but they were granted freely so far as spare parts for the repair of vehicles already on the road were concerned. He pointed out that there had been considerable difficulty in getting raw material for some of the repairs. This applied to some types of wood, while there was an enormous shortage of steel, and an overwhelming demand arising in no small measure from the huge demand made upon the railway and tramway rolling stock. Orders were booked up for many months to come. With regard to the statement that chassis had been refused from France, Sir Auckland said that the company had written to say that there had been some mistake in regard to the statement. He added that 116 motor lorries had been converted into omnibuses, and were either now on the streets or would be shortly. There were also under construction for the omnibus company 250 new omnibuses. With reference to the suggestion that more lorries should be run to augment the omnibus services, Sir Auckland Geddes pointed out that this would mean an alteration of the law. As to fares, he said that the increases were directly due to the increased cost of running. The alteration of conditions, the shortening of hours, etc., granted to railwaymen, although desirable, had come at the most awkward time they could possibly come, and the problem was a serious one which was hampering traffic services throughout the country. There was a greater accumulation of workers than before the war at a time when facilities were fewer. The managerial staffs of the railway companies had an appalling problem before them, and the country owed a great deal more to them than was generally recognised. He declared that while he certainly would not do anything to resist the appointment of a Select Committee, he did not feel at the moment that a Select Committee would help them very much. He promised the deputation that he would undertake to see that the matters they had placed before him were not allowed to drop, but would be pushed forward, and he would be very pleased to meet them in a few weeks' time to inform them what had been done. He thought a Select Committee would not lead them as rapidly forward as it was possible to move without one.

SELECT COMMITTEE PROMISED.

The agitation continued, and in the House of Commons, on May 26, Mr. Kennedy Jones asked the Leader of the House whether his attention had been called to the practically unanimous wish of the London and Greater London Members, representative of all parties, that a Select Committee should be at once appointed to investigate the grave congestion of the existing means of transport in the Metropolitan area, together with the persistent increase in fares, and with a view to recommendations being made for immediate improvement, either by way of legislation or otherwise. Mr. Bonar Law: Yes; I have discussed this matter with the Ministers concerned, and I hope that the work of a Select Committee on this subject will be useful. We propose therefore to set it up immediately.

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MOTOR TRAFFIC

Sir A. Geddes, in answer to Mr. Higham (Co. U., Islington, South), said the possibility of using Government lorries on the streets of London in order to relieve the overcrowding of omnibuses and tramways was being examined this week. Colonel Gibbs (Co. U., Bristol West), replying to a question addressed to the Prime Minister, informed Mr. Higham that if the investigation which was now proceeding showed that the fares charged by the London General Omnibus Company were excessive, he would consider what should be done. He hoped, however, that legislation would not be necessary.

CONSTITUTION OF SELECT COMMITTEE.

On Wednesday, May 28, it was stated that the Parliamentary Committee of Inquiry appointed by the Government to inquire into London traffic conditions would consist of the following:—Sir Frederick Hall, Colonel Assheton Pownall, Mr. Lane Mitchell, Mr. Kennedy Jones, Colonel Sir M. Archer-Shee, Mr. G. Balfour, Mr. Clement Edwards, Mr. J. D. Gilbert, Mr. C. F. Higham, Mr. Foreman, Mr. C. W. Bowerman, Mr. John Jones, Mr. Newbould, Sir R. Park Goff, and Major Joseph Nall.

At the same time it was intimated that the Government had decided to use War Department lorries to relieve the pressure on the tramways and omnibuses in the Metropolitan area. The first lorries would be run in connection with the services of the London General Omnibus Company. No seats were placed in the lorries used during the tube strike, but the vehicles would be fitted with chairs in order to make passengers as comfortable as possible. The lorries would be driven by drivers of the London General Omnibus Company, and would first be used as feeders in outlying districts.

OPENING OF ENQUIRY.

WITNESSES EXAMINED BY SELECT COMMITTEE.

The Select Committee met for the first time on Thursday, June 5, Mr. Kennedy Jones, M.P., presiding. The Superintendent of the Public Vehicles Department, Scotland Yard, Mr. Arthur Bassom, gave the number of motor omnibuses licensed on December 31 last as 2,277. In 1914 the number was 3,057. During last year 162 new omnibuses were licensed, and from January 1 to May 31 last 1,325 omnibuses, including several which had been renovated, were licensed. There was greater congestion in the wider than in the narrower streets, as the latter contributed to the more even flow of traffic. Omnibuses were restricted to a speed of 12 miles an hour, and while it might lessen congestion if they were permitted to travel at a rate of 15 miles, he believed that that would greatly increase the danger of the streets. The conditions arising out of the war had caused an increase in street accidents, although the number in the past year showed a decrease over the previous year. There were many difficulties in the way of using the queue system. He believed that an order empowering the police to regulate the routes on the shorter stretches would lessen the congestion considerably. Plans for a new type of taxi-cab have recently been approved by Scotland Yard, and when the manufacturers start to turn them out they will do so at the rate of 200 cabs a week.

Sir William Marwood, of the Board of Trade, gave evidence as to the powers of his department in relation to railways and tramways, and said that he believed the District Railway were running all the trains they could during the rush hours. There were 40 trains an hour, and he did not think it was possible to go beyond that. The rolling stock position was difficult. Some of the stock now in use ought to be in the repair shop. He did not think the Board of Trade would be hostile to the suggestion that there should be some overruling, unifying authority for the whole of the traffic of London. He thought it might be to the good if there was a traffic authority having complete control over omnibuses, queues, and tramways. There was a greater number of people travelling than ever before. The traffic had outgrown the facilities in an extraordinary way. The Board of Trade had no powers to deal with overcrowding.

THE ELECTRICAL VEHICLE COMMITTEE.

Mr. R. A. Chattock, who has been chairman of the Electric Vehicle Committee of Great Britain since its formation in 1913, has been compelled, owing to pressure of other work, to resign the position. At the meeting of the committee, held on May 9, Mr. Chattock's resignation was received with regret, and a resolution was passed thanking him for his services. The hon. secretary, Mr. F. Ayton was elected chairman for the year ending March 31, 1920. Mr. Shrapnell-Smith was re-elected vice-chairman, and Mr. J. Christie hon. treasurer. Mr. Ayton will continue to hold the position of hon. secretary. A Special Committee to investigate the question of the most suitable quality of rubber to employ for solid tires for electric vehicles has been appointed jointly by the Electric Vehicle Committee and the British Association of Rubber Tyre Manufacturers.

The committee's publication, *The Electric Vehicle*, will appear monthly, commencing with the June issue.

PETROL OF INFERIOR QUALITY.

Complaints have been made in the House of Commons of the inferior quality of the petrol now being sold to motorists. Mr. Bridgeman, in reply, said that the price of petroleum products had been so fixed as to balance as nearly as may be the cost to the Government after allowing for freight payments. All importations of petrol up to January 31 were on Government account, and the qualities imported were of the standard U.S. specification. The petroleum companies since that date have been free to import on their own account, and the sale of petrol is in their hands.

DRIVERS AS OMNIBUS OWNERS.

The organisation which has for some years enabled a number of drivers of motor cabs in London to become the owners of those vehicles has been extended with a view to afford facilities to omnibus drivers to become owners. The new venture will be known as the Motor Omnibus Co-operative Society, Limited, and membership will be restricted to the members of the London and Provincial Vehicle Workers' Union.

As the vehicles will weigh only about 30 cwt., they will be fitted with pneumatic tires, thus enabling the ordinary motor car speed of 20 miles per hour to be attained. It is stated that there will be accommodation for 26 passengers, as against seats for 34 provided on the existing double-deck omnibus.

ELECTRIC COMMERCIAL VEHICLES.

The paper read by Mr. Frank Ayton, honorary secretary of the Electric Vehicle Committee of Great Britain, and general manager and electrical engineer of Ipswich Corporation Tramways, on "The Electric Automobile for Commercial Use," at the Royal Automobile Club on May 14, was an interesting *résumé* of the present position of the electric vehicle. It briefly described the development in America, and gave at greater length an account of the progress made in this country. Mr. Ayton thinks that a careful consideration of the characteristics of the commercial electric must lead to the conclusion that its main field and application lies in substitution for horse haulage. It does not and cannot compete with the petrol vehicle where the latter is employed upon the work for which it is so well suited, viz., long distance haulage and express service. In reply to a discussion, Mr. Ayton admitted that his chief interest in electric vehicles was that the charging of batteries during the night would be profitable business for electricity supply stations. On the other hand, a number of the members of the Electric Vehicle Committee were thoroughly convinced of the great value of electric vehicles within certain limits.

NEW MOTOR TRADING COMPANY.

ORDERS FOR £1,000,000 WORTH OF CARS.

To the surprise of financiers and of the trade in some quarters it was announced on May 14 that there had been an over subscription to the first share issue at par of one million £1 shares in the newly-formed British Motor Trading Corporation, Limited. According to the prospectus the directors and their friends applied for over £600,000 of the capital.

This undertaking has been formed for (amongst other purposes) purchasing cars and commercial vehicles for individual and company users, and it is stated that the orders already placed with one company embrace £1,000,000 worth of cars. The prospectus stated that contracts had been made to take over from Crossley Motors, Limited, and from Straker-Squire, Limited, selling contracts for London and considerable areas of the country, and that negotiations are in progress with manufacturers for further important contracts, not only for the British Isles but also for export.

The company has been formed under the auspices of the Motor Union Insurance Company, and among the directors of the two bodies is Mr. Rees Jeffreys, the late secretary of the Road Board, who was formerly secretary of the Motor Union. The Motor Trading Corporation assert that their policy of placing large contracts will enable manufacturers to increase output and dispose of it at lower prices, and that the decrease in price should leave a considerable margin of profit to the Corporation after guaranteeing his return to the manufacturer and conferring substantial benefits upon the user. The Corporation also propose to create a widespread organisation for the repair, maintenance, letting on hire, and garaging of cars, commercial vehicles, and agricultural motor machinery.

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MOTOR TRAFFIC

PUBLIC CARRIAGE RED TAPE.

CHARGE AGAINST SCOTLAND YARD.

At the sitting of the London Members' Traffic Committee held on May 20 at the House of Commons, Mr. A. Smith, president of the Union of Licensed Vehicle Workers, said there were about 1,000 demobilised cab drivers who were unable, through a shortage of cabs, to return to their employment. Between 400 and 500 cabs could be put on the streets almost immediately if the police would license those with a 9-in. clearance. The 10-in. clearance was considered by the police sufficient to save the life of a person who might be knocked down by a taxi-cab. Several members of the committee remarked that such a clearance would be of no good in their cases.

Two demobilised drivers stated that the axle business was camouflage and a foolish restriction. They were up against red tape and nothing else. There were no restrictions on private cars. One witness complained of the tests required for different types of cabs. Drivers were going to be financed to enable them to buy the cabs if only they were allowed to use them.

Mr. R. C. Nesbitt, solicitor, said that 3,000 cabs had been deteriorating in the garages of the London Motor Cab Company since January, 1918, because the Home Secretary refused to sanction the shilling-a-mile fare. In the previous year the company had lost £70,000, and when the Home Secretary refused to grant the shilling a mile the directors felt they could not go on losing money. They were now ready to sell the cabs to the drivers. In 1914 the number of cabs in London was 9,000; to-day it was about 3,000.

The chairman of the committee undertook to place the points raised before the Home Secretary.

At a meeting of demobilised men held on May 16 under the auspices of the Licensed Vehicle Workers' Union, the Government were urged to allow chassis and spare parts to be imported. It was stated that the derelict cars at Kempton Park would furnish sufficient spare parts to enable an adequate number of cabs to be fitted up to provide work for demobilised cabmen.

ENGINEERS AND ROAD REFORM.

For many years the motoring organisations and the Roads Improvement Association have agitated to secure alterations in the general law governing the public highways on the lines now recommended to the Institution of Municipal and County Engineers by their Roads and Tramways Committee.

In presenting their recommendations the committee remark upon their importance in view of the part which good roads play in the well-being of the nation. In regard to breaking up roads for the purpose of laying mains, cables, drains, etc., it is suggested that the present regulations should be superseded, and that all statutory undertakings should be brought under a new Act, the chief provisions of which are set forth.

On the question of the compulsory acquirement of land for the purposes of new highways and for widenings and improvements, the committee suggest the granting of more extended powers such as are embodied in the special Acts in force in Birmingham, Liverpool, Sheffield, Swansea, and other large towns.

Special powers are suggested to enable highway authorities to prevent the formation of dangerous corners, for the purpose of improving existing dangerous corners, and securing the removal and pruning of trees, hedges, and other obstructions.

Finally, the committee recommend amendment of the law of extraordinary traffic, but as the County Councils' Association are dealing with this question they make no definite recommendations.

FARNBOROUGH OMNIBUS FARES.

In consequence of working costs having risen 150 or 200 per cent., the Aldershot and District Traction Company recently advanced the fares on their motor omnibuses between 33 and 50 per cent. One result was that Farnborough Council refused to renew the licences unless fares were lowered, and since May 23 the vehicles have refused to take up passengers in Farnborough except at inconvenient points on private land of the railway company and the military authorities. Indignation has been created among the public by the action of the Council, and the company have decided to apply for a mandamus calling on the Council to show cause for refusal of the licences.

MOTOR VEHICLES FOR MUNICIPALITIES.

GUISBOROUGH RURAL COUNCIL are obtaining a steam lorry.

KIDDERMINSTER RURAL COUNCIL contemplate purchasing a lorry

STOCKPORT CORPORATION have decided to obtain two omnibuses.

PETERSFIELD COUNCIL contemplate providing a motor fire engine.

OLDHAM CORPORATION are obtaining a motor pump and tender.

DUNDEE ELECTRICITY COMMITTEE propose the purchase of a steam lorry.

HORNSEY COUNCIL have decided to obtain six battery-propelled lorries.

COOKHAM RURAL COUNCIL have purchased a lorry at a cost of £1,200.

GLASGOW ELECTRICITY COMMITTEE have ordered two more 5-ton electric vehicles.

WHITEHAVEN COUNCIL have applied for sanction to borrow £1,150 for a motor fire engine.

BURY ST. EDMUNDS COUNCIL have bought a second-hand chassis as a tractor for the fire engine.

POPLAR COUNCIL have acquired four 5-ton steam tipping wagons from the Government at £570 each.

RUSHDEN URBAN COUNCIL require a loan of £1,250 for the purchase of a battery-propelled vehicle.

WILLESDEN COUNCIL have ordered a wagon with tipping body from Leyland Motors, Limited, at £1,000.

STIRLING COUNCIL have resolved to use motor wagons instead of horses for municipal carting and cleansing.

LUTON CORPORATION have placed a contract with Edison Accumulators, Limited, for a 3½-ton battery vehicle.

NORTHALLERTON URBAN COUNCIL have been advised by their surveyor to purchase a tractor and two wagons.

MANCHESTER CORPORATION have obtained two wagons from the Sentinel Wagon Works, Limited, for the gas department.

EAST SUSSEX COUNTY COUNCIL are expending £10,000 on the purchase of motor vehicles and plant for road maintenance.

LEIGHTON BUZZARD COUNCIL have received Local Government Board sanction to borrow £1,200 for purchasing a motor fire engine.

FULHAM COUNCIL have obtained two Halley lorries from the Road Board, who are disposing of vehicles brought back from road work in France.

BRADFORD CORPORATION have obtained a chassis, with detachable lorry and passenger bodies, for the sewage department, and a car lorry for the water department.

DEPTFORD COUNCIL have purchased three Halley lorries returned from road construction in France. The Works Committee state that the outlay will result in a saving to the rates.

ILFORD COUNCIL have been informed by the General Vehicle Company, Limited, that the price of a battery-propelled chassis with tipping body will be £1,362, an increase of £73.

GLOUCESTER COUNTY COUNCIL have resolved to purchase thirty of the heavy lorries returned from road work on the British front in France. At its present charges the Council consider that horse haulage will be too expensive.

PRESTON COUNCIL have appointed a sub-committee to consider the desirability of adopting mechanical traction for cleansing and carting work, the borough surveyor having reported on the merits of respective types as viewed by him in various towns.

BOURNEMOUTH COUNCIL have been recommended by the borough surveyor to accept a tender from Messrs. Dennis Brothers to supply a motor fire engine at £2,483, inclusive of an engine with first aid appliances and a 30-ft. ladder for £1,345, and a chassis at £1,038.

A YEAR'S OUTLAY ON WAR VEHICLES.—The report of the Auditor-General on the 1917-18 accounts of the Ministry of Munitions indicates that during the year mentioned £36,813,096 was spent on vehicles of all descriptions; upon tanks, £9,587,000 was allotted.

AN APPEAL TO LONDON MOTOR CAR OWNERS.—An appeal is made by the City of London Motor Transport Volunteers to the owners of motor cars and lorries in London to remember their "debt" to the limbless, paralytic, and wounded who are now housed in hospitals and homes all over London, and who are pining for a run out into the fresh air. Owners are requested to communicate with Major Sir John Lister Kaye, Bart., at Headquarters, City of London R.A.S.C., M.T.V., 235, Oxford Street, W.1. The M.T.V. supply all petrol.

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MOTOR TRAFFIC

MOTOR TRAFFIC NOTES.

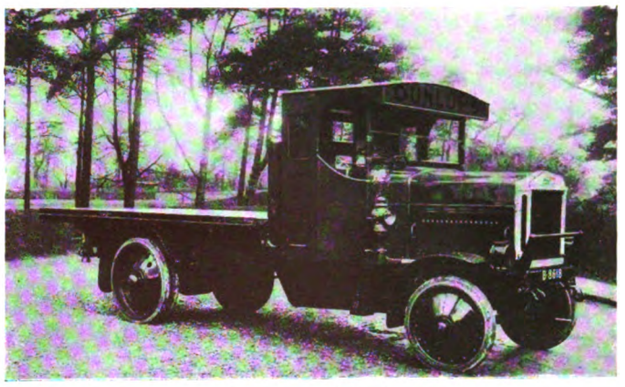
A Grant for London Roads.—Out of the sum of £79,000 required for road repairing in Hackney, the Road Board have granted £50,000 to the Borough Council.

Omnibuses for Portsmouth.—For the carrying out of the plans of the Tramways Committee for operating omnibuses in connection with the tramways, Portsmouth Corporation have agreed to purchase ten omnibus chassis of Thornycroft make.

Benzole Depots.—The Commercial Motor Users' Association, acting in conjunction with the National Benzole Association, have issued a list of suppliers of benzole throughout the country, and the hours during which this fuel can be obtained.

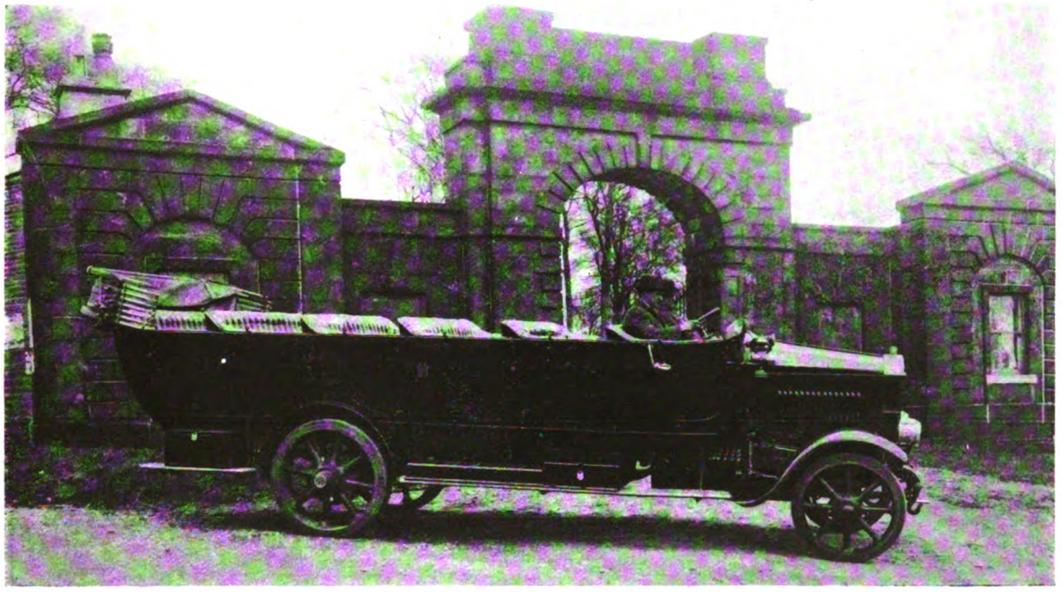
Applications for Omnibus Powers.—Among the local authorities applying for powers in the present session for the running of motor omnibuses are the London County Council, Middlesbrough, Coventry, Stockton-on-Tees, Stretford, Walsall, and Tynemouth.

Prices for Solid Tires.—For the supply and fixing of four solid rubber tires to a disinfecting van the following quotations were received by Westminster Council:—Macintosh and Company, £22 (accepted); Avon Rubber Company, £22 3s. 3d.; Dunlop Rubber Company, £23 3s. 11d.; Thornycroft and Company, £24 4s.

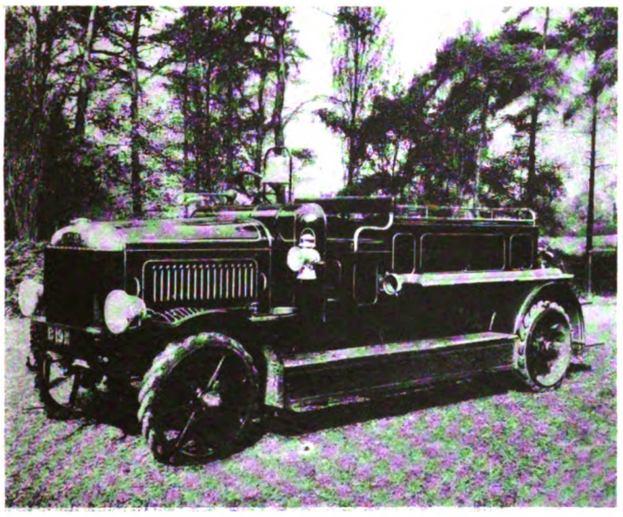


A Leyland Float.

Progress of Triplex Safety Glass.—The Triplex Safety Glass Company, which does a large business in wind screens, etc., made of safety glass, have increased their nominal capital to £200,000



A Karrier 50-H.P. Chars-a-banc, which does 8 to 10 Miles per Gallon on Hilly Roads.



A Leyland Fire Engine.

An issue of 60,000 £1 shares was offered to the shareholders at 15s. premium.

Improvement of West Bromwich Roads.—At an estimated cost of £53,000 the roads of West Bromwich are to be greatly improved. The plans submitted by Mr. Greatorex, the borough surveyor, include surfacing main roads and the principal secondary roads with tarmac.

Middlesex and the L.C.C Omnibus Bill.—With a view to impressing upon the London County Council the necessity of consulting the Middlesex County Council in such schemes, the latter body has decided to oppose the Bill of the former Council in which authority is sought to run motor omnibuses.

Scottish Rural Transport.—The question of rural transport facilities, including motor transport, has been considered by a special committee appointed by Mr. Munro, Secretary for Scotland. In the House of Commons on May 8 it was stated that the committee had presented their report, and that it was receiving consideration by Mr. Munro in consultation with the Scottish Board.

A Leyland Float for Dunlop Rubber Company.—One of the views on this page shows a G type Leyland float wagon, which has recently been delivered to the Dunlop Rubber Company for their cotton mills in Rochdale. The machine is a standard wagon, but is finished in unusual colours which the camera does not, of course, indicate, the colours being the familiar Dunlop yellow with black lettering.

Omnibus Fares.—In the House of Commons on May 13, Mr. Shortt, in reply to a question by Mr. Higham, said that an investiga-

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MOTOR TRAFFIC

tion into the increase in omnibus fares was proceeding, and would occupy some time. He had no power to order a reduction in the fares. If fares were found to be excessive it would have to be considered in what manner the Government should proceed.

MOTOR DRIVERS TRAINED DURING THE WAR.—More than 70,000 men were trained as drivers of mechanical vehicles of the Royal Army Service Corps during the war, and their services were of untold advantage on all the various fronts. At the outbreak of hostilities the corps numbered 500 officers and 6,000 of other ranks. When the armistice was signed the totals were 11,000 and 315,000 respectively.

CAMBERWELL APPLICATION TO THE ROAD BOARD.—Notwithstanding that London contributes a large sum in motor fuel taxation to the revenue of the Road Board, there are only a very few instances in which the Board have made a reasonable contribution to road maintenance in the metropolitan district. Camberwell Council have now applied for a grant of £51,600 for repairs of roads largely used by motor traffic of all descriptions.

ANOTHER ASPIRANT TO OMNIBUS OPERATION.—To the numerous municipal authorities who are applying this session for powers to run motor omnibuses, there has to be added the Cannock Urban Council. Extra means of locomotion are much needed in this Staffordshire mining district, and the Council ask for authority to operate omnibuses both within and outside the urban district. Walsall Council are lodging a petition against the Bill.

AUTO-CARRIER DAMAGED ON TRAMWAY.—The London County Council were cast in damages amounting to £23 and costs at Westminster County Court on May 29 in an action brought by Messrs. Arnold for damages to an auto-carrier. When turning out of Tunnel Avenue, Woolwich, into the main road the carrier skidded through the tramway line projecting one and half inches above the level of the setts. The carrier ran into a lorry and was damaged.

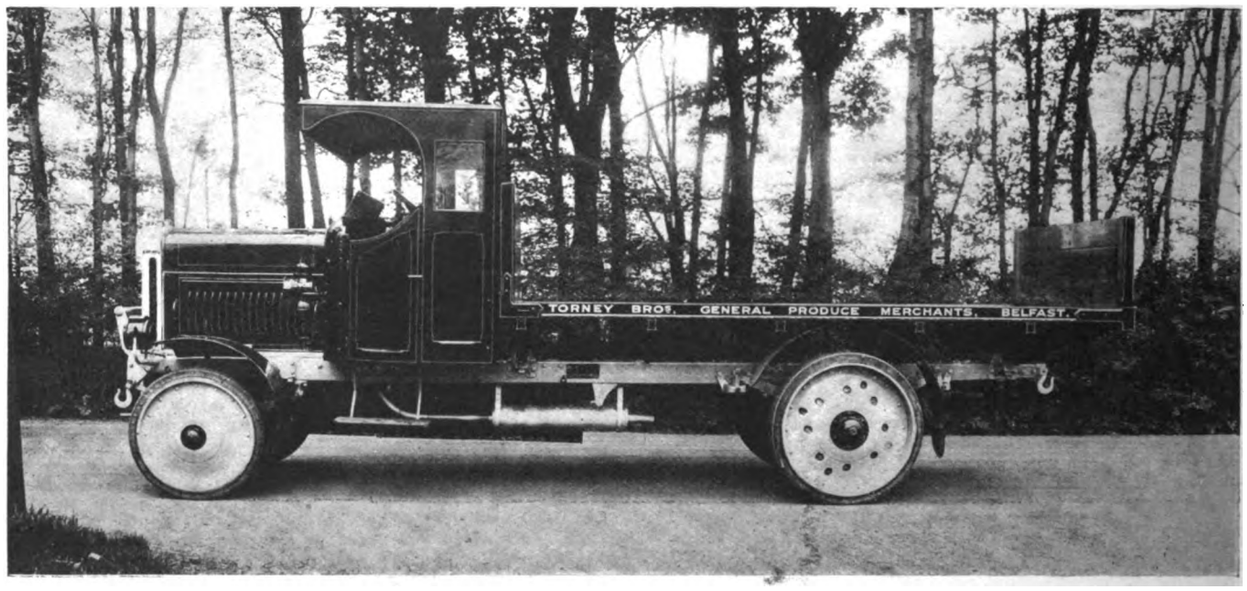
LONDON-SOUTH COAST OMNIBUS SERVICES.—Now that petrol shortage is a thing of the past, attention is being turned to the facilities provided for journeying by motor omnibuses between London and the chief towns in West Surrey, Kent, and Sussex, as well as the seaside resorts in the two latter counties. It is necessary to ascertain the connections if the passenger does not desire to lose time, and some of the trips are by chars-a-banc, for which a higher fare is charged.

FARMERS' TRANSPORT FACILITIES.—The transport facilities required by farmers, said Lord Ernle during a debate in the House of Lords on the Government's agricultural policy, were in the form of road motor services and not light railways. The Board of Agriculture had submitted a proposal to the Treasury and the matter would be taken over by the Ministry of Ways and Communications. In addition to a motor service what was termed a trench railway scheme would be extremely valuable.

CHARS-A-BANC REGULATIONS IN LANCASHIRE.—The Roads Committee of Lancashire County Council have imposed the following conditions for granting an application to put on a regular service of chars-a-banc in the Sabden-Clayton Moors-Clithero district for five years:—Car-mile payment of 2d. per mile and an initial fee of one guinea per annum per vehicle; only home-to-home routes to be used as defined by the county surveyor; journeys and number of passengers to be recorded daily, the book to be open to official inspection at any time.

BRITISH ARMOURED CARS IN RUSSIA.—Details of the landing of British armoured motor car division in Russia were given at a reunion of 250 members of the division at the Holborn Restaurant, by Commander Locker-Lampson, M.P. Upon reaching the port in Russia he was told that the squadron must return home. However, he insisted in landing a few sick men, and in that way the force was got ashore. Recently he received a telegram from General Denikin asking him to come to Russia again, and if he received the support of the Treasury he intended to do so.

ALBION MOTOR.—The directors' report for the year ended December 31 states that, after deducting necessary depreciations and other expenses, there remains a net profit of £76,511, which, with £17,513 brought forward, makes a total of £94,024. From this the directors have transferred £30,000 to the reserve fund, and after making allowances for debenture discount and expenses, and deducting preference and interim dividends, there remains £44,532. The directors recommend a final dividend of 15 per cent. on ordinary shares, making 20 per cent. for the year, and a carry forward of £25,153.



A Leyland Lorry.

WAR'S EFFECT ON CIVIL TRANSPORT.—We have already reported the decision of the committee of the Red Cross Society and the St. John Ambulance Association to distribute a large number of war ambulances for civil hospital work throughout the country. Two additional instances of beneficial effects resulting from the war have now to be recorded. The Scottish Red Cross Society have presented 100 ambulances to the St. Andrew Ambulance Association for use all over Scotland. The 50 ambulances which were presented to the Red Cross by the Scottish colliery owners and workers are being returned to the donors to be utilised as colliery ambulances.

EXETER-TORQUAY OMNIBUS SERVICE.—The Tramways and Streets Committees of Exeter Corporation have recommended the Council to attach a number of conditions to their approval of the proposed motor omnibus service between Exeter and Torquay. Among other conditions, they require that no passenger be taken up and set down within the limits of the city, that the minimum fare be 6d. for all passengers, and that certain specified streets be excluded from the routes. A committee representing Devonshire County Council and other highway authorities have advised that the institution of the new route should be authorised on condition that payments are made towards road maintenance, and that the County Council be allowed 5 per cent. of the gross receipts to cover the cost of checking the monthly returns and collecting the moneys.

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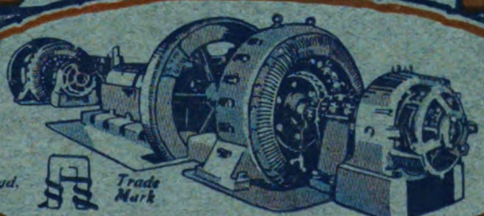

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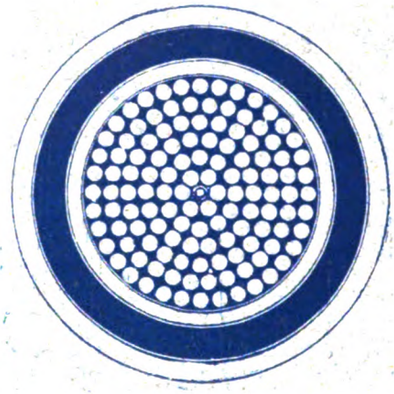

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CONSERVATION OF TIN.

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TIN COMMITTEE

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*TIN PERCENTAGE REDUCED TO COMPLY WITH COMMITTEE REGULATIONS. FOR PURPOSES OTHER THAN TRAMWAYS, OUR STANDARD ARROW IS UNCHANGED.

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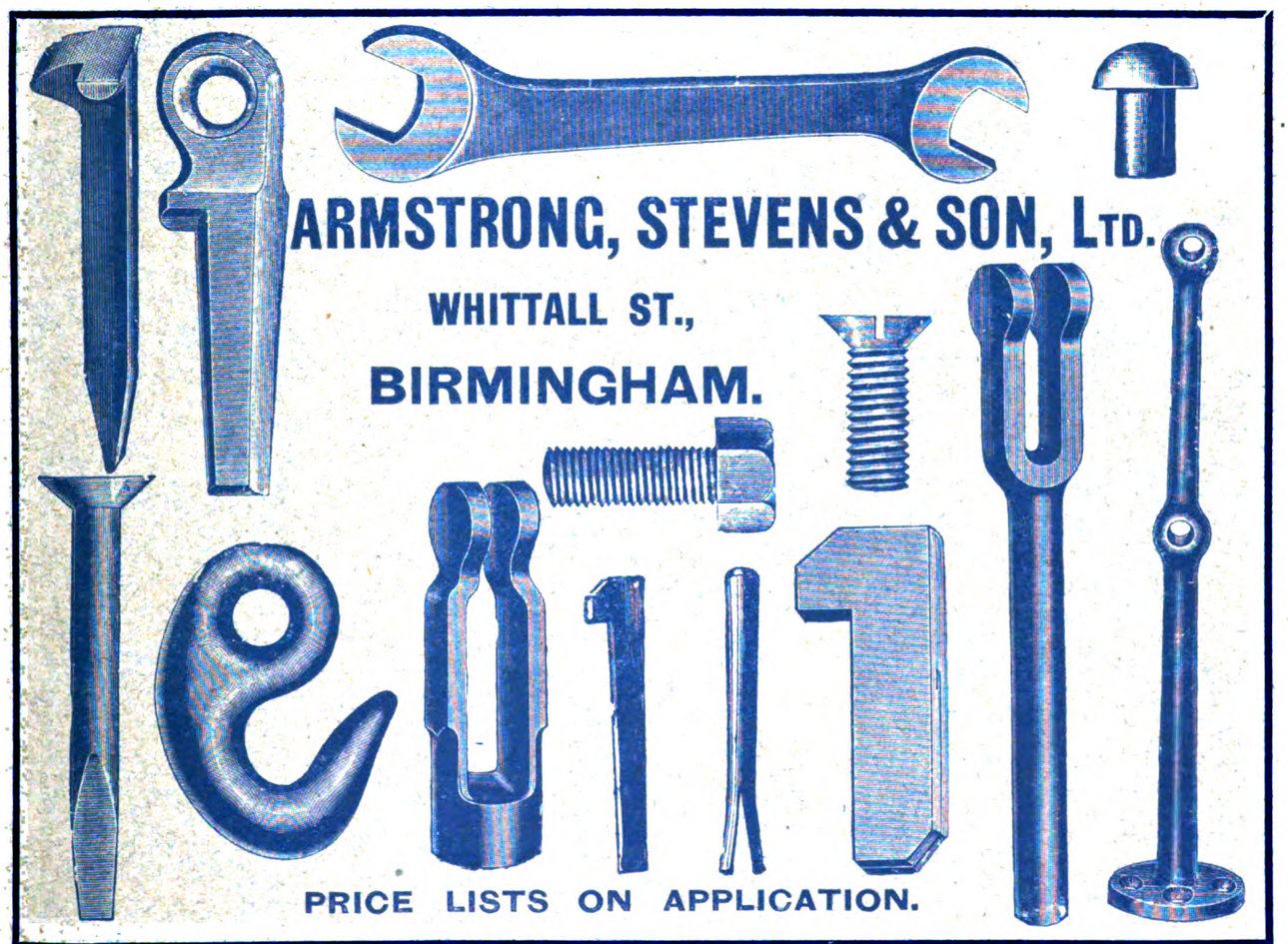

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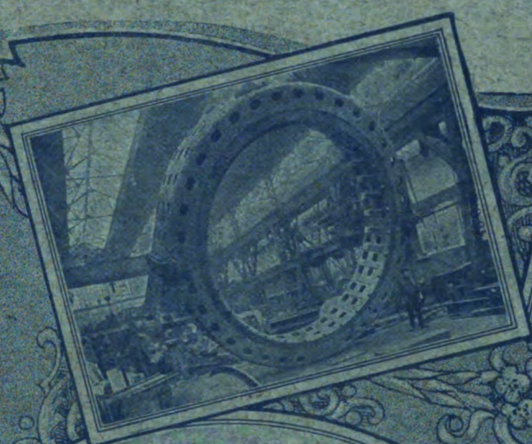
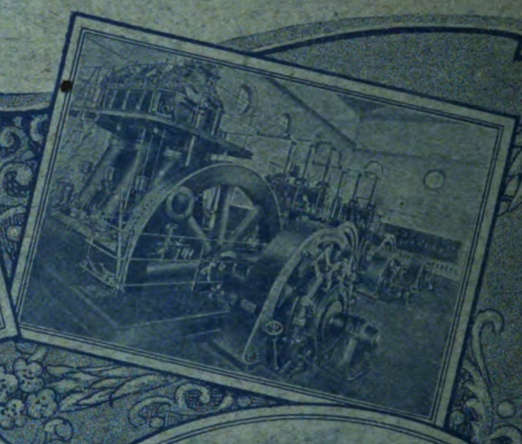
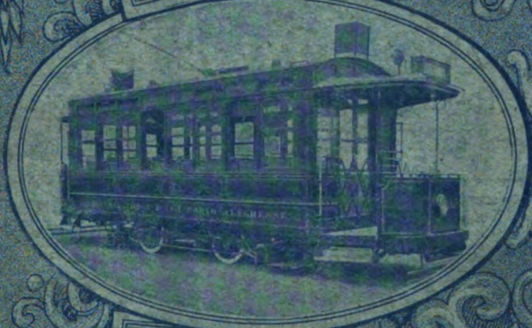

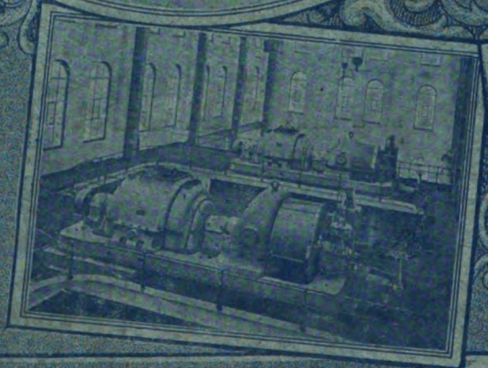

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FOUNDED, 1892.

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FEBRUARY 13, 1919
Vol. XLV., No. 8
WITH
"MOTOR TRAFFIC" SECTION

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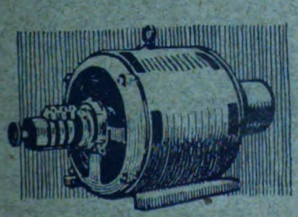

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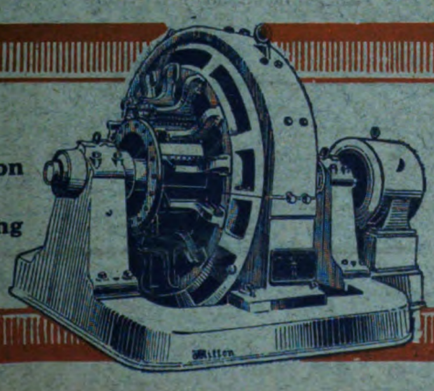

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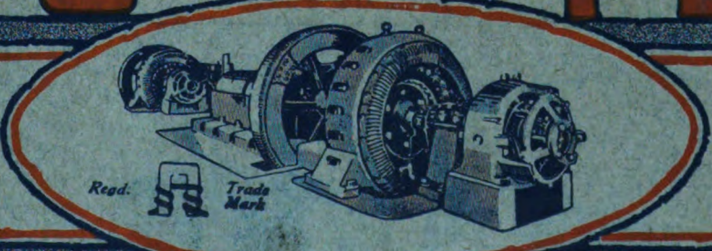

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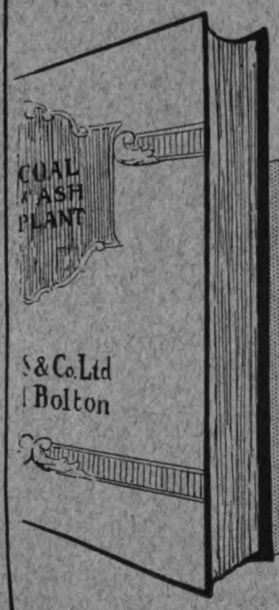

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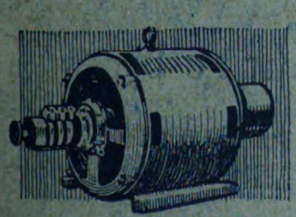

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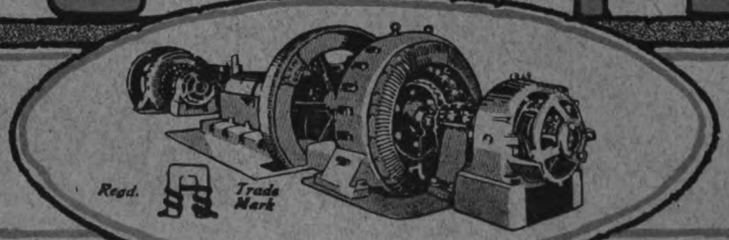

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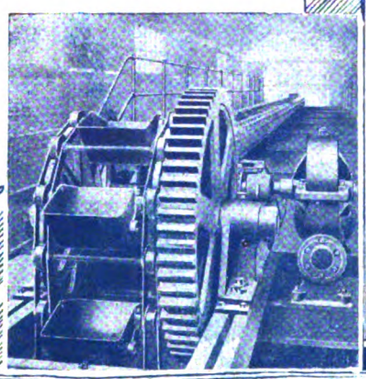

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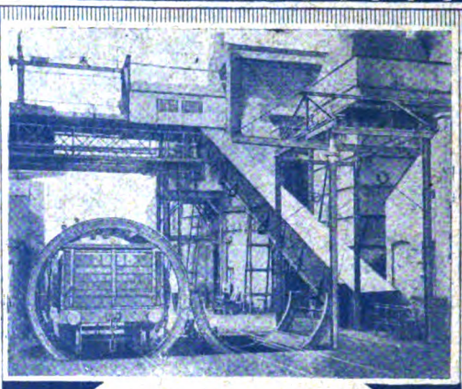

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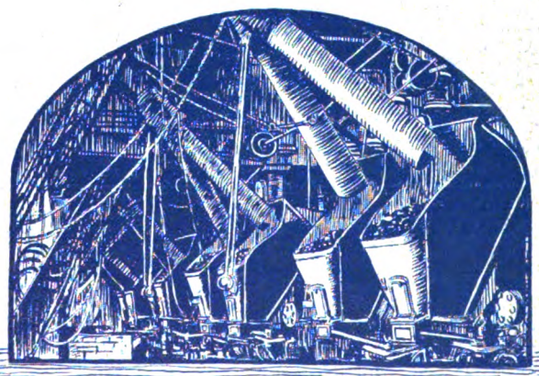

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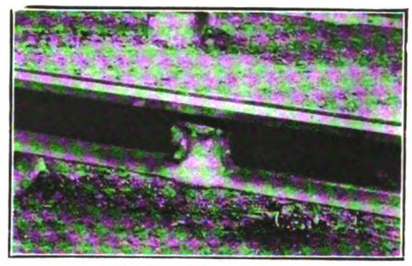

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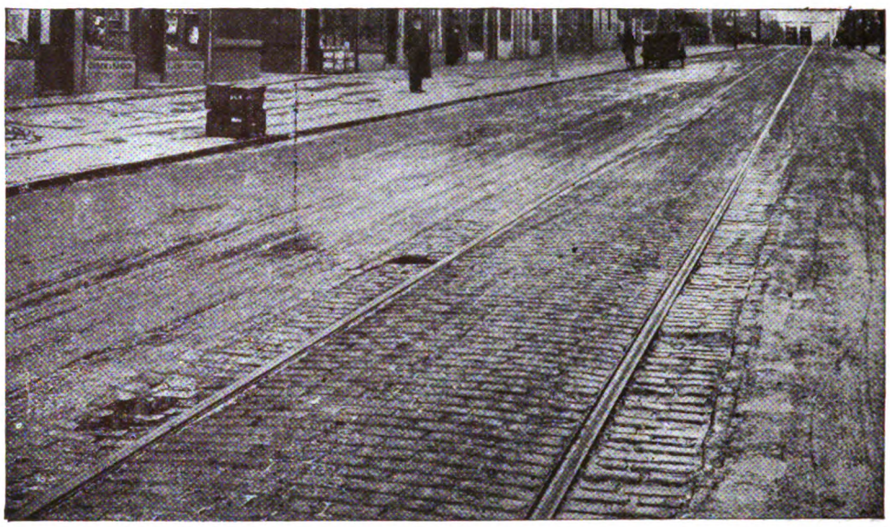
TRAMWAY FOUNDATIONS

These photographs were taken on the same day. The tracks are adjoining lengths and were laid at the same time.



This portion of Track is on a plain Concrete Foundation, unreinforced.

This portion of Track is on a Concrete Foundation reinforced with B.R.C. Fabric.

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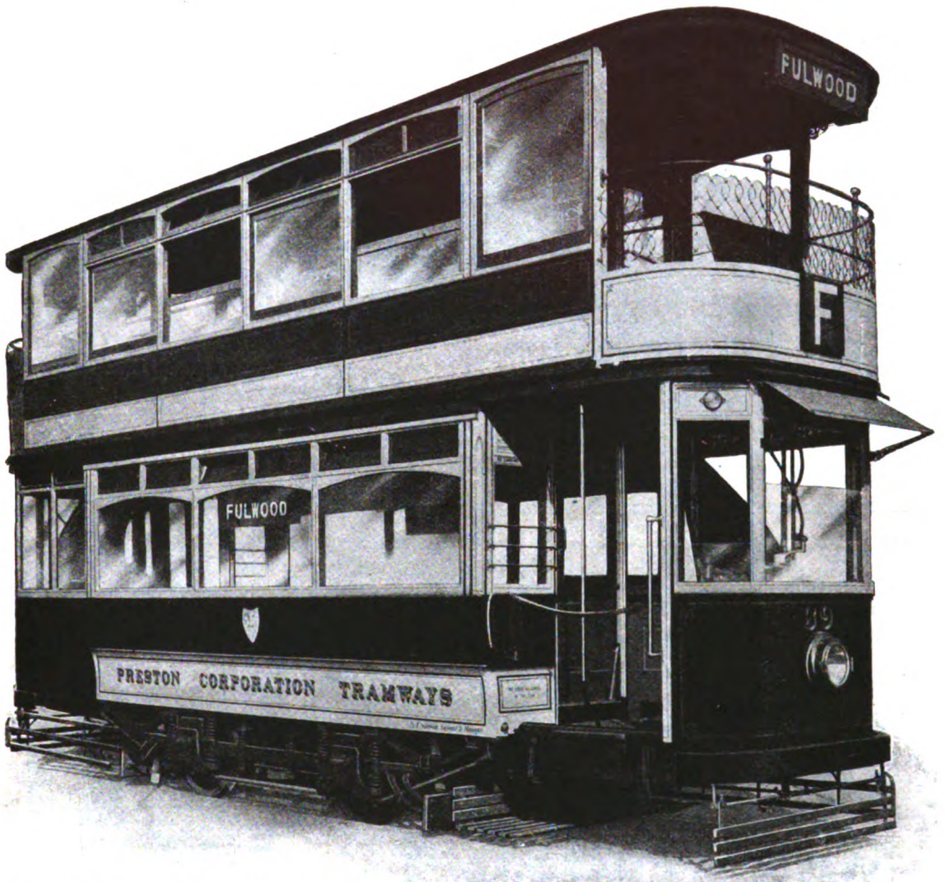

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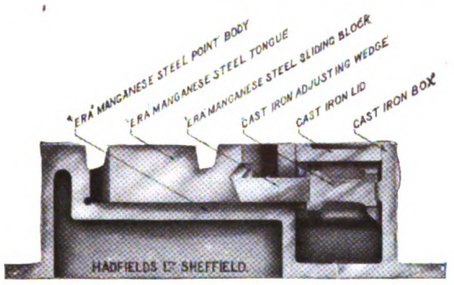
HADFIELD'S PATENT

"HADURA" POINT

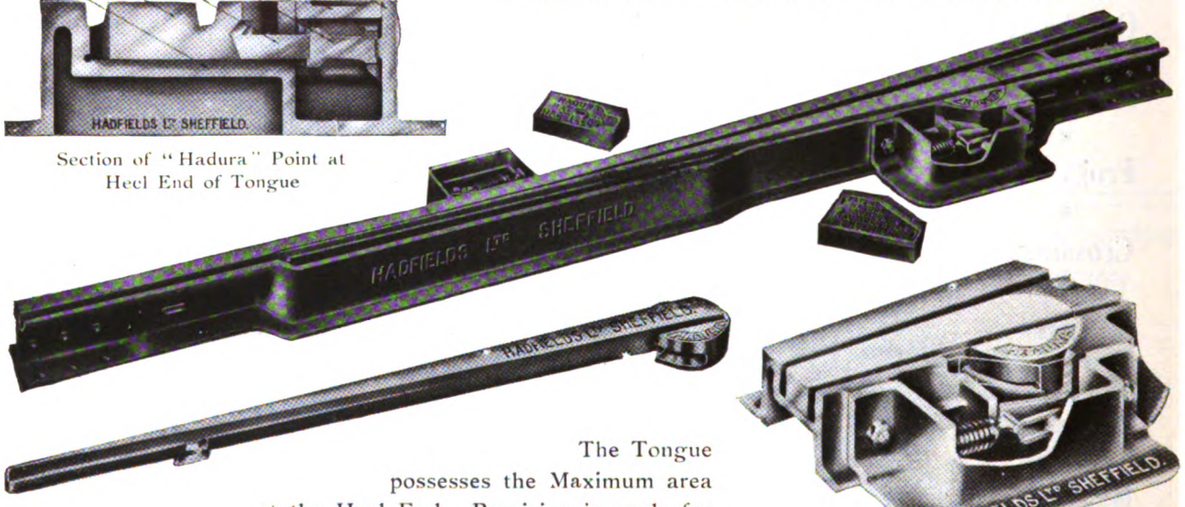


Section of "Hadura" Point at Heel End of Tongue

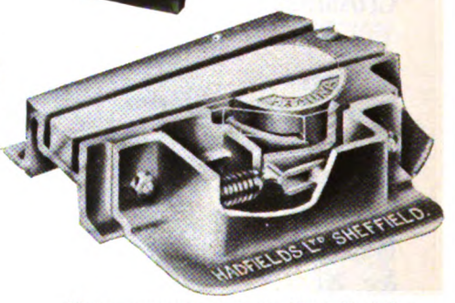
MADE OF HADFIELD'S PATENT

"Era" Manganese Steel

Fitted with Hadfield's Patent Universal Point Mechanism.



The Tongue possesses the Maximum area at the Heel End. Provision is made for automatically taking up slackness as wear takes place



Shows arrangement at Heel End for automatically taking up any wear

HADFIELD'S PATENT "HECLA" AND "HADURA" POINTS ARE THE ONLY POINTS ON THE MARKET WITH A PERFECT & CONTINUOUS BEARING FOR THE FULL LENGTH OF THE TONGUE

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COMPLETE LAY-OUTS AND JUNCTIONS

of every description

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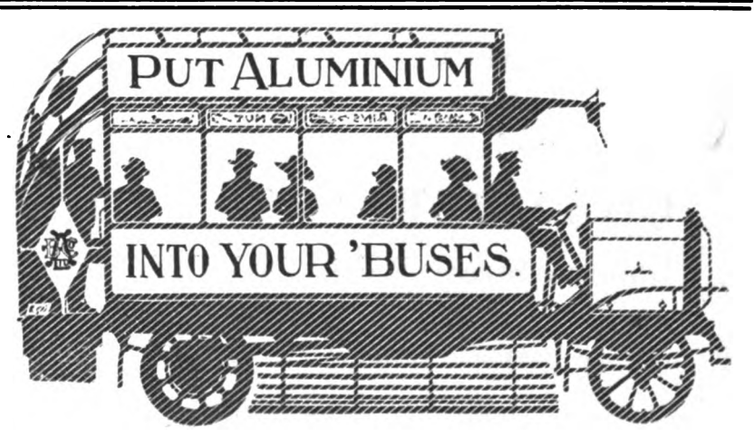

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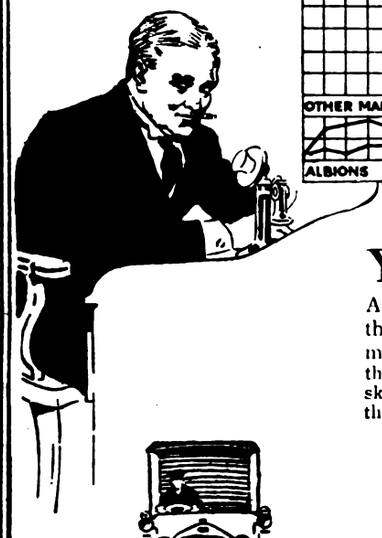

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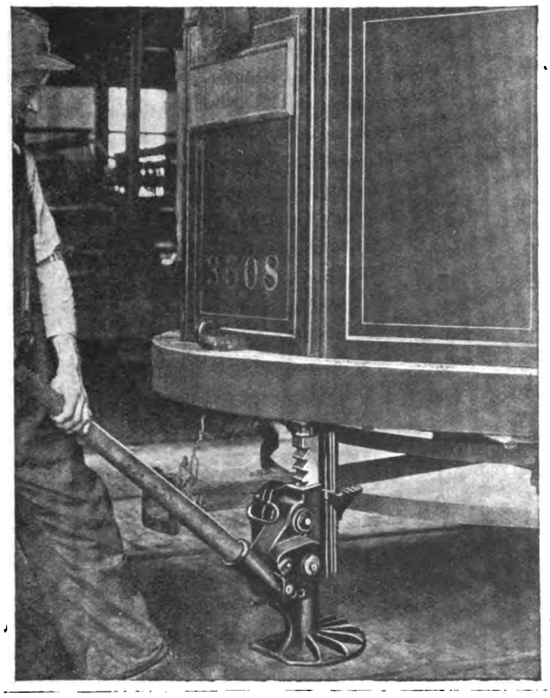

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Fleming, Birkby & Goodall, Ltd., Liversedge.
Hadfields, Ltd., Sheffield.
Scholey and Co., Ltd., London, E.C.
Tramway Supplies, Ltd., Leeds.
Wiseman, Alfred, Ltd., Birmingham.

GEARS AND PINIONS.
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Britannia Lamp & Accessories Co., London.
British Thomson-Houston Co., Ltd., Rugby.
Electro-Mechanical Brake Co., W. Bromwich.
Equipment & Engineering Co., London, W.C.
Fleming, Birkby & Goodall, Ltd., Liversedge.
Tramway Supplies, Ltd., Leeds.
Wiseman, Alfred, Ltd., Birmingham.

GEAR WHEELS.
Britannia Lamp & Accessories Co., Ltd., E.C.
Electro-Mechanical Brake Co., W. Bromwich.
Equipment & Engineering Co., London, W.C
Fleming, Birkby & Goodall, Ltd., Liversedge
Tramway Supplies, Ltd., Leeds.
Wiseman, Alfred, Ltd., Birmingham.

GENERATORS. (See Dynamos.)

GRINDING MACHINES.
Equipment & Engineering Co., London, W C.

GRINDING MACHINES, CAR WHEEL.
Britannia Lamp & Accessories Co., Ltd., E.C.
Thermit, Ltd., London, E.C.

GUARD WIRE.
Anger Manufacturing Co., Ltd., Preston.
Britannia Lamp & Accessories Co., Ltd., E.C.
Equipment & Engineering Co., London, W C.
Fleming, Birkby & Goodall, Ltd., Liversedge.
Gabriel & Co., Birmingham.
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Britannia Lamp & Accessories Co., Ltd., E.C.

HEATERS, ELECTRIC.
Britannia Lamp & Accessories Co., Ltd., E.C.

HOISTS.
Waygood-Otis, Ltd., London, S.E.

HYDRAULIC PRESSES.
Hadfields, Ltd., Sheffield.

IGNITION LEADS (FOR MOTOR CARS).
Henley's Telegraph Works Co., Ltd., London.
Kalker, E., & Co., Coventry.

INDICATORS. (See Destination Indicators.

INSULATING MATERIAL.
Britannia Lamp & Accessories Co., Ltd., E.C.
Equipment & Engineering Co., London, W.C.
Fleming, Birkby & Goodall, Ltd., Liversedge.
Kalker, E., & Co., Coventry.
Tramway Supplies, Ltd., Leeds.
Wiseman, Alfred, Ltd., Birmingham.

INSULATING VARNISHES.
Equipment & Engineering Co., London, W.C.
Fleming, Birkby & Goodall, Ltd., Liversedge.

INSULATORS, TRAMWAY.
Britannia Lamp & Accessories Co., Ltd., E.C.
British Thomson-Houston Co., Ltd., Rugby.
British Westinghouse Co., Ltd., London.
Equipment & Engineering Co., London, W.C.
Fleming, Birkby & Goodall, Ltd., Liversedge.
Henley's Telegraph Works Co., Ltd., London.
Tramway Supplies, Ltd., Leeds.
Wiseman, Alfred, Ltd., Birmingham.

IRONWORK FOR CAR BODIES.
Brockhouse, J., & Co., Ltd., West Bromwich.

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JOINT BOXES.
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Johnson & Phillips, Ltd., Charlton, S.E.
Tramway Supplies, Ltd., Leeds.

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Allen, Edgar, & Co., Ltd., Sheffield.
Hadfields, Ltd., Sheffield.

JOINTS, RAIL.
Allen, Edgar, & Co., Ltd., Sheffield.
Thermit, Limited, London, E.C.

JOURNAL BOXES.
Anger Manufacturing Co., Ltd., Preston.
Brill Company, J. G., London, S.W.
Hurst, Nelson & Co., Ltd., Motherwell.
United Electric Car Co., Ltd., Preston, Lancs.

JOURNAL BOX PACKING.
Beckett, Laycock & Watkinson, Ltd., London.
Equipment & Engineering Co., London, W.C.
General Seating Co., Ltd., London, E.C.

LAMPS, ELECTRIC.
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British Thomson-Houston Co., Ltd., Rugby.
British Westinghouse Elec. & Mfg. Co., Ltd.

LEATHERS (UPHOLSTERY).
General Seating Co., Ltd., London, E.C.

LIFE GUARDS.
Gabriel & Co., Birmingham.
Hurst, Nelson & Co., Ltd., Motherwell.

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Anger Manufacturing Co., Ltd., Preston.
Brill Company, J. G., London, E.C.
Equipment & Engineering Co., London, W.C.
Hurst, Nelson & Co., Ltd., Glasgow.
White Motors and Accessories, Ltd.

LIFTS.
Waygood-Otis, Ltd., London, S.E.

LIGHTNING ARRESTERS.
Britannia Lamp & Accessories Co., Ltd., E.C.
British Thomson-Houston Co., Ltd., Rugby.
British Westinghouse Elec. & Mfg. Co., Ltd.
Equipment & Engineering Co., London, W.C.

LINCRUSTA WALTON.
General Seating Co., Ltd., London, E.C.

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British Thomson-Houston Co., Ltd., Rugby
Dick, Kerr, & Co., Ltd., London.
Electro-Mechanical Brake Co., W. Bromwich
Equipment & Engineering Co., London, W.C.
Fleming, Birkby & Goodall, Ltd., Liversedge
Green, Geo. W., & Co., Ltd., Feltham.
Henley's Telegraph Works Co., Ltd., London
Standard Underground Cable Co., London.
Tramway Supplies, Ltd., Leeds.
Wiseman, Alfred, Ltd., Birmingham.

LOCK WASHERS.
Britannia Lamp & Accessories Co., Ltd., E.C.
Equipment & Engineering Co., London, W.C.

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British Thomson-Houston Co., Ltd., Rugby.
British Westinghouse Co., Ltd., London.
Dick, Kerr, & Co., Ltd., London, E.C.
Hurst, Nelson & Co., Ltd., Motherwell.

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Leyland Motors, Ltd., Leyland, Lancs.

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Hoyt Metal Co., Ltd., London, W.

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Commercial Cars, Ltd., Luton.
Leyland Motors, Ltd., Leyland, Lancs.

MOTOR OMNIBUS FITTINGS.
Gabriel & Co., Birmingham.

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Commercial Cars, Ltd., Luton.
Leyland Motors, Ltd., Leyland, Lancs.

MOVABLE CAR STEPS.
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Equipment & Engineering Co., London, W.C.
Hurst, Nelson & Co., Ltd., Motherwell.

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OVERHEAD LINE TOOLS.
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Kearsley, Robert, & Co., Ltd., Ripon, Yorks.

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PANELS, MAHOGANY, etc.
Brill Company, J. G., London, S.W.
General Seating Co., Ltd., London, E.C.

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Allen & Simmonds, Ltd., Reading.

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Lorain Steel Company, London.
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Tramway Supplies, Ltd., Leeds.

POLES, METAL.
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Dick, Kerr, & Co., Ltd., London.
Equipment & Engineering Co., London, W.C.
Stewarts & Lloyds, Ltd., Glasgow.
Tramway Supplies, Ltd., Leeds.

PORTABLE RAILWAYS.
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Tyne Metal Co., Ltd., Hexham-on-Tyne.

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Anger Manufacturing Co., Ltd., Preston.
Britannia Lamp & Accessories Co., Ltd., E.C.
Equipment & Engineering Co., London, W.C.
Tramway Supplies, Ltd., Leeds.

RAIL CLEANERS.
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Brill Company, J. G., London, E.C.
Britannia Lamp & Accessories Co., Ltd., E.C.
Equipment & Engineering Co., London, W.C.
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Hurst, Nelson & Co., Ltd., Motherwell.

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Equipment & Engineering Co., London, W.C.
Thermit, Ltd., London, E.C.
Tramway Supplies, Ltd., Leeds.

RAIL JOINTS.
Hadfields, Ltd., Sheffield.
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(Continued on page xx.)

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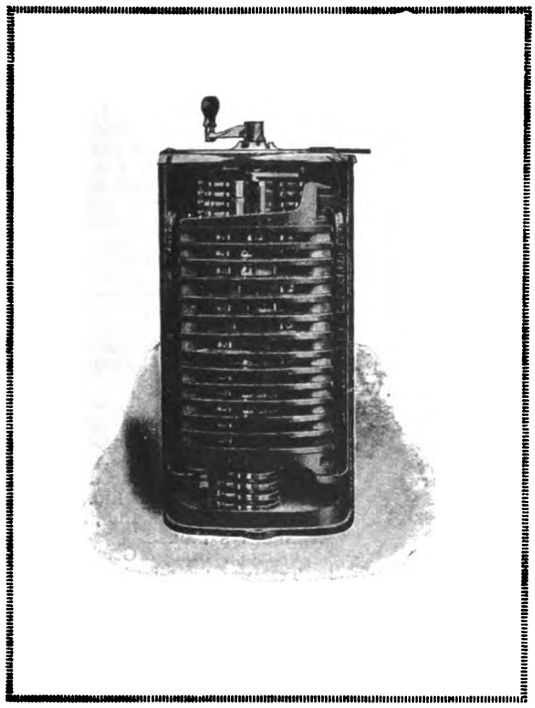

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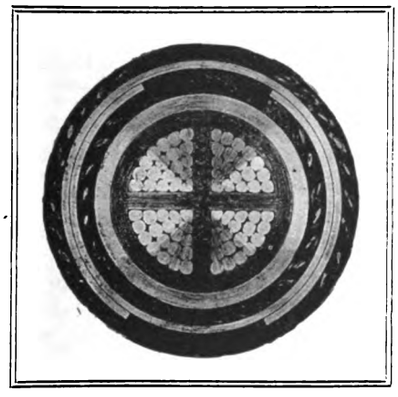

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Titan Trackwork Co., Ltd., Sheffield.

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British Westinghouse Co., Ltd., London.
Dick, Kerr, & Co., Ltd., London.

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Gabriel & Co., Birmingham.
General Seating Co., Ltd., London, E.C.
Hurst, Nelson & Co., Ltd., Motherwell.
Yates & Co., Ltd., John, Aston Manor.

RATTAN.
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Brill Company, J. G., London, E.C.
General Seating Co., Ltd., London, E.C.

RESISTANCES.
Electro-Mechanical Brake Co., W. Bromwich.

ROLLER BEARINGS.
Hurst, Nelson & Co., Ltd., Motherwell.

SANDING DEVICES.
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Gabriel & Co., Birmingham.
Tramway Supplies, Ltd., Leeds.

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Brill Company, J. G., London, S.W.
Gabriel & Co., Birmingham.
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Tramway Supplies, Ltd., Leeds.
United Electric Car Co., Ltd., Preston, Lancs.

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Equipment & Engineering Co., London, W.C.
General Seating Co., Ltd., London, E.C.

SIDE GUARDS.
Anger Manufacturing Co., Ltd., Preston.
Equipment & Engineering Co., London, W.C.

SIMPLEX JACKS.
Anger Manufacturing Co., Ltd., Preston.
Equipment & Engineering Co., London, W.C.

SNOW PLOWS.
Brill Company, J. G., London, S.W.
Hurst, Nelson & Co., Ltd., Motherwell.

SPRINGS.
Allen, Edgar, & Co., Ltd., Sheffield.
Anger Manufacturing Co., Ltd., Preston.
Brill Company, J. G., London, E.C
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Hadfields, Ltd., Sheffield.
Hurst, Nelson & Co., Ltd., Motherwell.
Smith Bros. & Hill, Ltd., West Bromwich.

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Hurst, Nelson & Co., Ltd., Motherwell,

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British Thomson-Houston Co., Ltd., Rugby.
British Westinghouse Elec. & Mfg. Co., Ltd.
Dick, Kerr, & Co., Ltd., London.

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Leyland Motors, Ltd., Leyland, Lancs

STEEL FORGINGS.
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Baker, John, & Co., Rotherham.
Brill Company, J. G., London, E.C.
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Brill Company, J. G., London, S.W.
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Equipment & Engineering Co., London, W.C.
Hadfields, Ltd., Sheffield.
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Commercial Cars, Ltd., Luton.
Equipment & Engineering Co., London, W.C.
Leyland Motors, Ltd., Leyland, Lancs.
Tramway Supplies, Ltd., Leeds.

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Brill Company, J. G., London, S.W.
Electro-Mechanical Brake Co., W. Bromwich.
Equipment & Engineering Co., London, W.C
Hurst, Nelson & Co., Ltd., Motherwell.
Tramway Supplies, Ltd., Leeds.

TRACK SANDERS.
Anger Manufacturing Co., Ltd., Preston.
Brill Company, J. G., London, S.W.
Gabriel & Co., Birmingham.
Hurst, Nelson & Co., Ltd., Motherwell.
Tramway Supplies, Ltd., Leeds.

TRACK TOOLS AND APPLIANCES.
Allen, Edgar, & Co., Ltd., Sheffield.
Britannia Lamp & Accessories Co., Ltd., E.C.
Green, Geo. W., & Co., Ltd., Feltham.
Yates & Co., Ltd., John, Aston Manor.

TRAMWAY FOUNDATIONS.
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TROLLEY CORD.
Britannia Lamp & Accessories Co., Ltd., E.C.
Equipment & Engineering Co., London, W.C.

TROLLEY HANGERS.
Anger Manufacturing Co., Ltd., Preston.
Britannia Lamp & Accessories Co., Ltd., E.C.
British Westinghouse Co., Ltd., London.
Equipment & Engineering Co., London, W.C.
Fleming, Birkby & Goodall, Ltd., Liversedge.
Tramway Supplies, Ltd., Leeds.
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Britannia Lamp & Accessories Co., Ltd., E.C.

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TROLLEY WHEELS AND HEADS
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Britannia Lamp & Accessories Co., Ltd., E.C.
British Aluminium Co., Ltd., London, E.C.
British Thomson-Houston Co., Ltd., Rugby.
Electro-Mechanical Brake Co., W. Bromwich.
Fleming, Birkby & Goodall, Ltd., Liversedge.
Gabriel & Co., Birmingham.
Tramway Supplies, Ltd., Leeds.
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Britannia Lamp & Accessories Co., Ltd., E.C.
Equipment & Engineering Co., London, W.C.
Frederick Smith & Co., Salford, Manchester.
Standard Underground Cable Co., London.
Tramway Supplies, Ltd., Leeds.

TRUCK BRAKES.
Anger Manufacturing Co., Ltd., Preston.
Brill Company, J. G., London, E.C.
Peckham Truck & Eng. Co., London, S.W.
Tramway Supplies, Ltd., Leeds.

TRUCKS, CAR.
Brill Company, J. G., London, S.W.
Dick, Kerr, & Co., Ltd., London.
Electro-Mechanical Brake Co., W. Bromwich.
Hurst, Nelson & Co., Ltd., Motherwell.
Lorain Steel Company, London.

VARNISHES.
Docker Bros., Ltd., London.
Fleming, Birkby & Goodall, Ltd., Liversedge.
Pinchin, Johnson, & Co., Ltd., London, E.C.

WASHERS.
Smith Bros. & Hill, Ltd., West Bromwich.

WELDED JOINTS.
Thermit, Limited, London, E.C.

WHEELS AND AXLES.
Allen, Edgar, & Co., Ltd., Sheffield.
Baker, John, & Co., Rotherham.
Brill Company, J. G., London, S.W.
British Griffin Co., Ltd., London.
Equipment & Engineering Co., London, W.C.
Hadfields, Ltd., Sheffield.
Hurst, Nelson & Co., Ltd., Motherwell.

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Baker, John, & Co., Rotherham.
Hurst, Nelson & Co., Ltd., Motherwell.

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British Aluminium Co., Ltd., London, E.C.

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Henley's Telegraph Works Co., Ltd., London.
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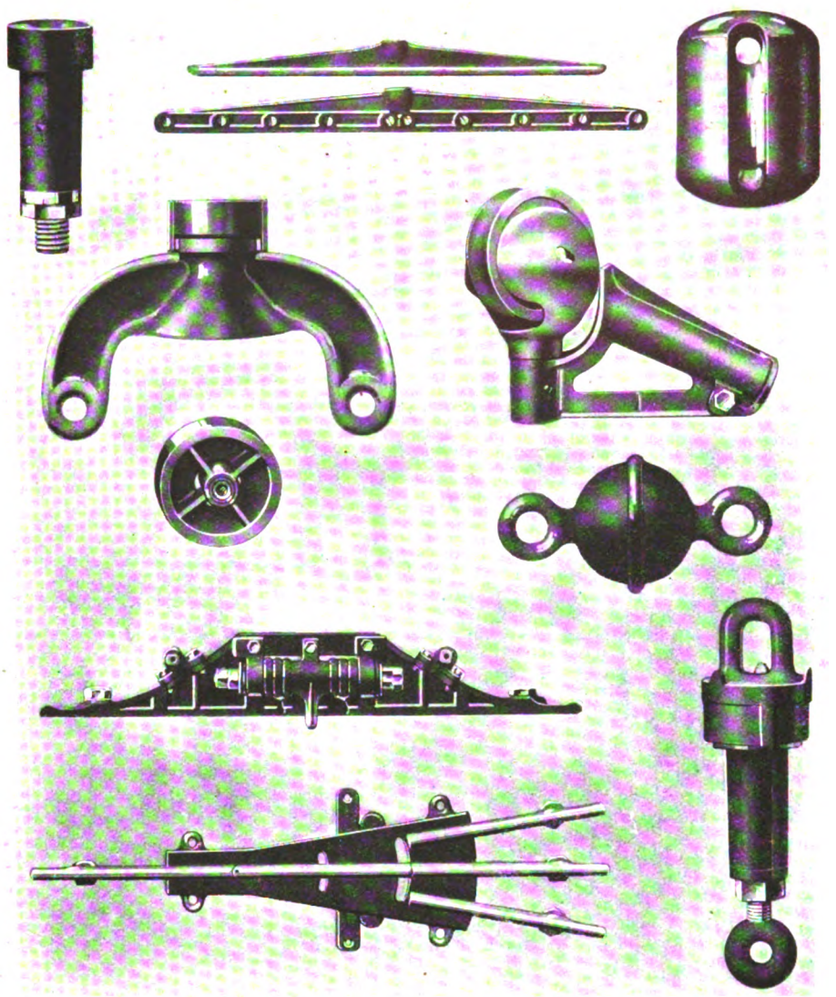

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NAMES OF PRINCIPAL OFFICERS
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MUNICIPAL TRAMWAYS, pp. xxiii-xxiv. COMPANY TRAMWAYS, pp. xxiv-xxvi.

TRAMWAYS (BOARD OF TRADE) COMMITTEE AND AREA SUB-COMMITTEES, p. xxvi.

*** For Particulars of Track and Equipment, Reference should be made to pages xxvii-xxx, March 14, 1918.

Aberdare Urban District Tramways, Gadlys Estate, Aberdare. [T.A., Tramways, Aberdare: T.N., 17.] *Gen. Manager and Elec. Engineer*, A. J. Abraham; *Traffic Supt.*, H. King; *Chairman Try. Com.*, Coun. E. Stonelake.

Aberdeen Corporation Tramways, Municipal Buildings, Union Street, Aberdeen. [T.A., Trams, Aberdeen; T.N. 826.] *Gen. Manager and Eng.*, W. Forbes; *Per. Way Eng.*, J. Gordon (*Burgh Surveyor*); *Chairman Try. Com.*, Dean of Guild Meff.

Accrington Corporation Tramways, Market Hall, Accrington. [T.A., Trams, Accrington; T.N., 2212.] *Gen. Manager and Eng.*, H. Pilling; *Per. Way Eng.*, W. J. Newton; *Chairman Try. Com.*, Ald. T. E. Higham; *Vice-Chairman*, Coun. Morley.

Ashton-under-Lyne Corporation Tramways, Tramway Depot, Mossley Road, Ashton. [T.A., Tramways, Ashton; T.N., 325.] *Gen. Manager*, Ernest Holt; *Elec. Eng.*, N. Appelbee; *Chairman Try. Com.*, Ald. R. S. Oldham; *Vice-Chairman*, Ald. Waterhouse.

Ayr Corporation Tramways, Town Building, Ayr. [T.A., Trams, Ayr; T.N., 123.] *Gen. Manager and Eng.*, William Grant; *Burgh Elec. Eng.*, R. Marshall; *Per. Way Eng.*, John Young; *Rolling Stock Supt.*, Alf. Somerville; *Convener Try. Com.*, Coun. J. R. Learmont; *Vice-Chairman*, Bailie T. Murray.

Bacup Corporation Tramways.—Town Hall, Bacup, Lancs. [Lines leased to and worked by Rawtenstall Corporation.] *Town Clerk*, J. Entwistle; *Boro' Eng.*, G. Bradley; *Chairman Try. Com.*, Ald. Sir J. H. Maden; *Vice-Chairman*, Coun. J. H. Lord.

Barking Town Urban District Tramways, East Street, Barking. [T.N., 156 East Ham.] *Eng. and Manager*, W. Holmes; *Acting Engineer and Manager*, W. E. Kidner; *Chairman Try. Com.*, Coun. J. Ranson.

Barton-upon-Irwell District Council Light Railways, Barton-upon-Irwell.
[Line leased to and worked by the Lancashire United Tramways Co., *q.v.*]

Batley Corporation Tramways, Batley, Yorks. *Engineer*, S. D. Jones; *Chairman Try. Com.*, Coun. F. W. H. Auty; *Vice-Chairman*, Coun. J. E. Oldroyd.
[Lines leased to and worked by the Yorkshire (Woollen District) Electric Tramways, Ltd., *q.v.*]

Belfast City Tramways, Tramways Office, Sandy Row, Belfast. [T.A., Tramways, Belfast; T.N., 2444.] *Gen. Manager*, J. S. D. Moffet; *Traffic Manager*, R. McMaster; *City Elec. Eng.*, T. W. Bloxam; *Per. Way Eng.*, E. S. Pinkerton; *Chief Eng.*, H. Vernon; *Chairman Try. Com.*, Coun. W. C. Turner; *Vice-Chairman*, Coun. J. McDonald.

Bexley Urban District Council Tramways and Dartford Light Railways, Broadway, Bexleyheath, Kent. [T.A., Stokes, Tramways, Bexley; T.N., 79.] *Gen. Manager and Elec. Eng.*, H. P. Stokes; *Chief Assist.*, J. Makin; *Chairman Try. Com.*, Coun. G. Sheldon.

Birkenhead Corporation Tramways, Laird Street, Birkenhead. [T.A., Tramways Manager, Birkenhead; T.N., 1110.] *Gen. Manager*, C. Clarke; *Borough Sur. and Eng.*, C. Brownridge; *Rolling Stock Supt.*, R. Chadwick; *Chairman Try. Com.*, Coun. H. Halsall; *Vice-Chairman*, Coun. R. Frame.

Birmingham Corporation Tramways, The Council House, Congreve Street, Birmingham. [T.A., Trams, Birmingham; T.N., Central 7,000.] *Gen. Manager*, A. Baker; *City Elec. Eng.*, R. A. Chattock; *Traffic Supt.*, J. McDonnell; *Per. Way Eng.*, C. E. S. Bill; *Chief Engineer*, R. H. Dickinson; *Car Works Supt.*, T. C. Winfield; *Chairman Try. Com.*, Coun. Lee.

Blackburn Corporation Tramways, Tramways Office, Blackburn. [T.A., Tramways, Blackburn; T.N., 4321.] *General Manager*, J. H. Cowell; *Elec Eng.*, P. P. Wheelwright; *Traffic Manager*, E. Greek; *Car Shed Supt.*, H. W. Seymour; *Chairman Try. Com.*, Ald. W. Thompson; *Vice-Chairman*, Coun. C. Higham.

Blackpool Corporation Tramways, West Caroline Street, Blackpool. [T.N., 67.] *Gen. Manager*, C. Furness; *Traffic Supt.*, C. I. Baker; *Resident Eng.*, F. Field; *Chairman Try. Com.*, ——————; *Vice-Chairman*, Coun. H. Brooks.

Bolton Corporation Tramways, Bradshawgate, Bolton. [T.A., Manager, Tramways, Bolton; T.N., 490.] *General Manager*, J. Barnard; *Elec. Eng.*, W. J. H. Wood; *Per. Way Eng.*, E. Ll. Morgan; *Rolling Stock Supt.*, C. Beech; *Chairman Try. Com.*, Coun. P. Higson; *Vice-Chairman*, Coun. J. R. Horrocks.

Bootle Corporation Tramways, Electricity Works, Pine Grove, Bootle. [T.N., 424.] *Elec. Eng.*, T. D. Clothier; *Chairman Try. Com.*, Ald. Booth; *Vice-Chairman*, Coun. Pennington.
[Lines worked by Liverpool Corporation Tramways.]

Bournemouth Corporation Tramways, Tramways Offices, Lansdowne Crescent, Bournemouth [T.A., Tramways, Bournemouth; T.N., 1701.] *General Manager*, I. Bulfin; *Chief Assistant & Elec. Eng.*, H. Vickers; *Traffic Supt.*, G. F. Glass; *Chairman Try. Com.*, Coun. Bell; *Vice-Chairman*, Coun. McCabe.

Bradford Corporation Tramways, Central Office, 7, Hall Ings, Bradford. [T.A., Tramways, Bradford; T.N., 2381 and 2382.] *Gen. Manager*, R. H. Wilkinson; *Asst. Elec. Eng.*, J. W. Dawson; *Traffic Supt.*, T. Stirk; *City Elec. Eng.*, T. Roles; *Chairman Try. Com.*, Ald. Enoch Priestley; *Vice-Chairman*, Coun. I. F. Akeroyd.

Brighton Corporation Tramways, Lewes Road, Brighton. [T.A., Tramways, Brighton; T.N., 353 P.O.] *Eng. & Manager*, William Marsh; *Traffic Supt.*, W. N. Brooks; *Rolling Stock Supt.*, W. Orchard; *Per. Way Eng.*, F. N. Hudson; *Chairman Try. Com.*, Coun. T. J. Braybon.

Burnley Corporation Tramways, Queen's Gate, Burnley. [T.N., 46.] *Gen. Manager*, Henry Mozley; *Boro. Elec. Eng.*, J. E. Starkie; *Boro. Surveyor*, G. H. Pickles; *Chairman Try. Com.*, Coun. E. Heap; *Vice-Chairman*, Coun. Irving.

Burton-on-Trent Corporation Tramways, Guild Street, Burton-on-Trent. [T.N., 202.] *Manager*, A. B. Slater; *Engineer*, T. Hall; *Chairman Try. Com.*, Ald. J. S. Rowland; *Vice-Chairman*, Ald. Lowe.

Bury Corporation Tramways, Market Place, Bury. [T.N., 26.] *Gen. Manager*, Frank Buckley; *Boro. Elec. Eng.*, S. J. Watson; *Chairman Try. Com.*, Ald. T. S. Collinge; *Vice-Chairman*, Coun. Hargreaves.

Cardiff Corporation Tramways, Central Offices, The Hayes, Cardiff. [T.A., Tramways, Cardiff; T.N., 1211, 1240, 1350, and 377.] *Gen. Manager and Elec. Eng.*, A. Ellis; *Deputy Manager*, C. G. M. New; *Traffic Manager*, H. David; *Rolling Stock Supt.*, Jas. Preston; permanent way under supervision of *City Engineer*, E. J. Elford; *Chairman Try. Com.*, Ald. Sir J. W. Courtis, J.P.; *Vice-Chairman*, Ald. R. J. Smith.

Chester Corporation Tramways, Station Road, Chester. [T.N., 166.] *Manager*, W. H. Ellis; *Elec. Eng.*, S. E. Britton; *Per. Way Eng.*, W. M. Jones; *Chairman Try. Com.*, Ald. J. Jones; *Vice-Chairman*, Coun. A. S. Dutton.

Chesterfield Corporation Tramways, Chatsworth Road, Chesterfield. [T.A., Tramways, Chesterfield; T.N., 78.] *Gen. Manager and Elec. Eng.*, W. A. Toppin; *Traffic Manager*, F. Root; *Chairman Try. Com.*, Ald. E. Shentall (Mayor); *Vice-Chairman*, Coun. Woodhead.

Colchester Corporation Tramways, Magdalen Street, Colchester. [T.A., Tramways, Colchester; T.N., 92.] *Gen. Manager and Engineer*, R. C. Bullough; *Chairman Try. Com.*, Coun. A. M. Jarmin (Deputy Mayor); *Vice-Chairman*, Coun. G. F. Wright (Mayor).

Colne Corporation Tramways, Colne, Lancashire. *General Manager and Engineer*, T. G. Richardson; *Chairman Try. Com.*, Coun. R. Knight.

Coventry Corporation Tramways, Priestley's Bridge, Coventry. [T.A., Tramways, Coventry; T.N., 1014.] *Engineer and General Manager*, T. R. Whitehead; *Assistant Engineer*, W. M. Milnes; *Chairman*, Coun. H. W. Wale; *Vice-Chairman*, Coun. J. Grant.

Croydon Corporation Tramways, Tramways Office, Thornton Heath, Surrey. [T.A., Tramways, Croydon; T.N., 406, Croydon.] *Tramways Manager*, T. B. Goodyer; *Chairman Try. Com.*, Coun. A. A. Thomson; *Vice-Chairman*, Ald. G. J. Allen, J.P.

Darlington Corporation Tramways, Haughton Road, Darlington. [T.A., Tramways, Darlington; T.N., 2435.] *General Manager and Elec. Eng.*, J. R. P. Lunn; *Traffic Supt.*, J. Fraser; *Chairman Try. Com.*,

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Dartford Urban District Council Light Railways, Dartford. *Chairman Try. Com.*, Coun. R. Bennett; *Vice-Chairman*, Coun. W. J. Bourne.
[Lines worked by Bexley U.D. Council, *q.v.*]

Darwen Corporation Tramways, Lorne Street, Darwen. [T.N., 104.] *Gen. Manager and Eng.*, G. A. Newsome; *Boro. Elec. Eng.*, F. M. Fletcher; *Chairman Try. Com.*, Coun. Geo. Pickup; *Vice-Chairman*, Coun. Butterworth.

Derby Corporation Tramways, 4, Victoria Street, Derby. [T.N., 410.] *Gen. Manager*, F. Harding; *Elec. Eng.*, T. P. Wilmshurst; *Per. Way Eng.*, J. Ward; *Chairman Try. Com.*, Coun. W. Eaton, J.P.

Doncaster Corporation Tramways, Grey Friar's Road, Doncaster. [T.A., Rayner, Doncaster, T.N., 43.] *Boro. Elec. Eng. and Manager*, E. S. Rayner; *Chairman Try. Com.*, Coun. S. Balmforth; *Vice-Chairman*, Coun. T. Bramworth.

Dover Corporation Tramways, Town Hall, Dover. [T.A., Trams, Dover; T.N., 294.] *Gen. Manager*, E. H. Bond; *Per. Way Eng.*, W. C. Hawke (Boro. Surveyor); *Chairman Try. Com.*, Coun. Barwick; *Vice-Chairman*, Coun. Norman.

Dundee Corporation Tramways, Town House Buildings, Dundee. [T.N., 1340]; *Gen. Manager and Eng.*, Peter Fisher; *Elec. Eng.*, H. Richardson; *City Eng.*, J. Thomson; *Chairman Try. Com.*, G. A. Johnston.

East Ham Corporation Tramways, Nelson Street, East Ham. [T.N., 611 and 100, East Ham.] *Gen. Manager and Elec. Eng.*, W. C. Ullmann; *Chairman Try. Com.*, Ald. M. Oakes J.P.

Eccles Corporation Tramways, Eccles. *Elec. Eng.*, H. W. Angus; *Per. Way Eng.*, T. S. Picton; *Chairman Try. Com.*, Coun. Alexander; *Vice-Chairman*, Ald. Pearson.
[Lines worked by Salford Corporation.]

Edinburgh Corporation Tramways, City Chambers, Edinburgh. *Gen. Manager*, R. S. Pilcher; *Traffic Supt.*, W. P. Young; *Burgh Engineer*, A. H. Campbell; *Chairman Try. Com.*, Coun. J. Harrison.
[Edinburgh tramways are owned by the Corporation, but are at present worked by cable traction, and are leased until June, 1919, to the Edinburgh and District Tramways Company, Ltd.]

Erith Urban District Council Tramways, Tramway Depôt, Walnut Tree Road, Erith. [T.A., Tramways, Erith; T.N., 36.] *Gen. Manager and Elec. Engineer*, J. C. Williams; *Chairman Try. Com.*, Coun. G. C. Humphreys.

Exeter Corporation Tramways, Heavitree Street, Exeter. *Gen. Manager*, R. O. Baldwin; *Elec. Eng.* H. D. Munro; *Per. Way Eng.*, T. Moulding; *Chairman Try. Com.*, Ald. H. B. Varwell; *Vice-Chairman*, Coun. F. G. Towill.

Farnworth Urban District Council Tramways, Albert Road, Farnworth. *Chairman Try. Com.*, Coun. R. H. Cunliffe, J.P.; *Vice-Chairman*, Coun. Stanley.
[Lines leased to the South Lancashire Tramways Co.]

Glasgow Corporation Tramways, 46, Bath Street, Glasgow. [T.A., Trams, Glasgow; T.N., 1040, Douglas.] *Gen. Manager*, J. Dalrymple; *Deputy Gen. Manager*, L. Mackinnon; *Chief Eng.*, J. Ferguson; *Elec. Eng.*, E. T. Goslin; *Sec. and Treasurer*, J. N. Wilson; *Chairman Try. Com.*, Coun. Kelly; *Vice-Chairman*, Coun. M'Whirr.

Gloucester Corporation Light Railway, Bristol Road Depôt, Gloucester. [T.A., Tramways, Gloucester; T.N. 155.] *Gen. Manager and Elec. Eng.*, F. H. Corson; *Chairman Try. Com.*, Coun. J. O. Roberts; *Vice-Chairman*, Coun. C. J. Ramstedt.

Great Yarmouth Corporation Tramways, Caister Road, Great Yarmouth. [T.N. 265.] *Gen. Manager*, F. L. Turner; *Elec. Eng.*, Gordon Bryant; *Per. Way. Eng.*, J. W. Cockrill (Borough Surveyor); *Chairman Try. Com.*, Ald. J. T. C. Salmon; *Vice-Chairman*, Ald. McCowan.

Halifax Corporation Tramways, Skircoat Road, Halifax. [T.N., 36 and 382.] *Traffic Manager*, Jas. D. Caird; *Try. Eng.*, J. W. Galloway; *Per. Way Eng.*, J. Lord (Boro. Eng.); *Chairman Try. Com.*, Ald. C. F. Spencer; *Vice-Chairman*, Ald. A. Fawcett.

Haslingden Corporation Tramways, John Street, Haslingden. *Gen. Manager, Elec. Eng., and Per. Way Eng.*, Barnes Kay; *Chairman Try. Com.*, Coun. Waddington; *Vice-Chairman*, Coun. Haworth.

Herne Bay Pier Tramway (owned and worked by Herne Bay U.D.C.), Herne Bay. [T.N., 22.] *Res. Manager*, P. W. Carey.

Heywood Corporation Tramways, Heywood, Lancs. [T.N., 47.] *Gen. Manager*, D. H. Davies; *Per. Way Eng.*, J. B. Nuttall; *Chairman Try. Com.*, Ald. J. Ashworth; *Vice-Chairman*, Ald. T. Popple, J.P.

Huddersfield Corporation Tramways, Northumberland Street, Huddersfield. [T.N., 698 and 898.] *Gen. Manager and Eng.*, A. A. Blackburn; *Track Eng.*, K. F. Campbell (Borough Eng.); *Elec. Eng.*, J. W. Turner; *Traffic Supt.*, T. Hartley; *Chairman Try. Com.*, Coun. E. H. Sellers; *Vice-Chairman*, Coun. T. Canby.

Hull Corporation Tramways, Alfred-Gelder Street, Hull. [T.N., 444, Corporation] *Acting Manager*, David Tarbert; *Engineer*, F. W. Bricknell (City Engineer) [T.N., 943, Corporation]; *Elec. Eng.*, J. Wilkinson [T.N., 443, Corporation]; *Chairman Try. Com.*, Colonel Walker; *Vice-Chairman*, Coun. D. Willoughby.

Ilford Urban District Council Tramways, Ley Street, Ilford. [T.N., 684.] *Manager and Engineer*, L. E. Harvey; *Chairman Try. Com.*, Coun. O. Waters; *Vice-Chairman*, Coun. J. Lowe.

Ipswich Corporation Tramways, Constantine Road, Ipswich. [T.A., Ayton, Tramways, Ipswich; T.N., 354.] *Gen. Manager and Elec. Eng.*, Frank Ayton; *Traffic Supt.*, A. Butler; *Rolling Stock Supt.*, W. A. Fairhead; *Chairman Try. Com.*, Coun. E. C. Ransome (Mayor); *Vice-Chairman*, Coun. W. P. Burton.

Kearsley Urban District Council Tramways, Council Office, Kearsley, Farnworth, S.O. *Clerk U. D. C.*, H. Martin.
[Lines leased to and worked by the South Lancashire Tramways Co.]

Keighley Corporation Tramways, Coney Lane, Keighley. [T.A., Tramways, Keighley; T.N., 13 & 263.] *Gen. Manager and Elec. Eng.*, H. Webber; *Chairman Try. Com.*, Coun. A. Smith.

Kilmarnock Corporation Tramways Electricity Works, Kilmarnock. [T.N., 95.] *Elec. Eng. and Manager*, W. C. Bexon; *Consulting Engineers*, Kennedy and Jenkin; *Convener Try. Com.*, Coun. R. Lorimer.

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ELECTRIC TRAMWAYS IN THE UNITED KINGDOM

Kirkcaldy Corporation Tramways, Electricity Works Victoria Road, Kirkcaldy. [T.A., Tramways, Kirkcaldy. T.N., 124, 174, and 175.] *Manager & Elec. Eng.*, O. F. Francis; *Traffic Manager*, Jas. Fisher; *Chairman Try. Com.*, Coun. G. Fergusson.

Lancaster Corporation Tramways, Electricity Works, Lancaster. [T.A., Milnes, Tramways, Lancaster; T.N., 1, L.] *Gen. Manager & Elec. Eng.*, G. C. Milnes; *Acting Boro. Electrical Engineer and Tramways Manager*, J. B. Patterson; *Traffic Manager*, W. T. Charlton; *Chairman Try. Com.*, Coun. T. Wilkinson.

Leeds City Tramways, Swinegate, Leeds. [T.A., Tramways, Leeds; T.N., 21601; *General Manager*, J. B. Hamilton; *Traffic Supt.*, A. Daggett; *Elec. Eng.*, John Burbridge; *Highways and Per. Way Eng.*, E. W. Cockerlyne; *Car Works Supt.*, G. E. Watmough; *Chairman Try. Com.*, Ald. R. A. Smithson; *Vice-Chairman*, Ald. H. Brown.

Leicester Corporation Tramways, 20 and 22, Humberstone Gate, Leicester. [T.N., 2177.] *Manager & Sec.*, A. F. Lucas; *Boro. & Try. Eng.*, E. G. Mawbey; *Boro. Elec. Eng.*, T. R. Smith; *Cons. Engs.*, Kincaid, Waller & Manville; *Chairman Try. Com.*, Ald. S. Flint, J.P.; *Vice-Chairman*, Ald. G. Banton, J.P.

Leith Corporation Tramways, 165, Leith Walk, Leith. [T.N., 415.] *Gen. Manager*, F. A. Fitzpayne; *Per. Way Eng.*, J. R. Findlay (*Burgh Eng.*); *Chairman Try. Com.*, Bailie Goalen.

Leyton District Council Tramways, Car Depot, Lea Bridge Road, Leyton, E. [T.A., Tramways, Leyton; T.N., 17 Walthamstow.] *Manager*, F. Schofield; *Elec. Eng.*, F. Harman Lewis; *Per. Way Eng.*, E. H. Essex; *Chairman Try. Com.*, Coun. F. M. Read.

Lincoln Corporation Tramways, Brayford Side North, Lincoln. [T.A., Clegg 109 Lincoln; T.N., 109]. *General Manager and Elec. Eng.*, Stanley Clegg; *Chairman Try. Com.*, Ald. W. S. White.

Liverpool Corporation Tramways, 24, Hatton Garden, Liverpool. [T.A., Tramways, Liverpool; T.N., 6054 and 7701, Central.] *General Manager*, C. W. Mallins; *Deputy Manager*, P. Priestly; *Per. Way Eng.*, J. A. Brodie (*City Engineer*); *Rolling Stock Supt.*, T. Ridyard; *Chairman Try. Com.*, Ald. E. Russell Taylor; *Vice-Chairman*, Ald. F. Smith, J.P.

London County Council Tramways, 23, Belvedere Road, Lambeth, London, S.E.1. [T.A., Lotram, Watloo, London; T.N., 4335 Hop] *General Manager*, A. L. C. Fell; *Traffic Manager*, J. K. Bruce; *Electrical Engineer*, P. L. Riviere; *Rolling Stock Eng.*, W. E. Ireland; *Per. Way Eng.*, J. Welling; *Chairman Highways Com.*, W. J. Squires; *Vice-Chairman*, Lieut.-Comm. A. Cooper Rawson.

Lowestoft Corporation Tramways, Norwich Road, Lowestoft. [T.N., 87.] *Gen. Manager*, H. H. Saunders; *Elec. Eng.*, W. R. May; *Chairman Try. Com.*, Coun. F. Spashett (Mayor).

Maidstone Corporation Tramways, Tramway Offices, Tonbridge Road, Maidstone. [T.A., Lambert, Tramways, Maidstone; T.N., 448] *Gen. Manager and Elec. Eng.*, A. T. Lambert; *Chairman Try. Com.*, Ald. D. T. J. Lyle; *Vice-Chairman*, Coun. Green.

Manchester Corporation Tramways, 55, Piccadilly, Manchester. [T.A., Tramways, Manchester; T.N., 7800 City.] *Gen. Manager*, J. M. McElroy; *Traffic Sup.*, J. T. Oakes; *Elec. Eng.*, J. J. McMahon; *Chief Civil Eng.*, H. Mattinson; *Rolling Stock Supt.*, G. R. Blackburn; *Chairman Try. Com.*, Ald. J. Bowes; *Vice-Chairman*, Ald. A. W. Chapman.

Middlesex County Council Light Railways, Middlesex Guildhall, Westminster, London, S.W. *County Eng.*, H. T. Wakelam, M.I.C.E.; *Chairman of Light Railways Com.*, County Ald. H. Burt; *Vice-Chairman*, County Ald. F. Goodyear.

Middleton Corporation Tramways.
[These lines are leased to and worked by Manchester Corporation Tramways.]

Nelson Corporation Light Railways, Charles Street, Nelson. [T.N., 115.] *Manager and Elec. Eng.*, G. F. Nayler; *Per. Way Eng.*, W. Shackleton; *Chairman Try. Com.*, Coun. W. F. Cooke.

Newcastle-upon-Tyne Corporation Tramways, Manors, Newcastle. [T.A., Traction, Newcastle; T.N., 913 and 914 Central.] *Gen. Manager & Engineer*, Ernest Hatton; *Traffic Supt.*, T. Chalder; *Per. Way Eng.*, W. J. Steele; *Chairman Try. Com.*, Coun. R. Mayne; *Vice-Chairman*, Coun. A. M. Sutherland (Lord Mayor).

Newport (Mon.) Corporation Tramways, Town Hall, Newport, Mon. [T.A., Dynamo, Newport, Mon.; T.N., 3111 and 2932, Nat.] *Gen. Manager*, N. J. Young; *Boro. Elec. and Tramways Eng.*, A. Nichols Moore; *Chairman Try. Com.*, Coun. J. Moxon; *Vice-Chairman*, Ald. F. Phillips.

Northampton Corporation Tramways, St. James', Northampton. [T.N., 279 & 280.] *Gen. Manager and Elec. Eng.*, J. F. Cameron; *Chairman Try. Com.*, Coun. T. D. Lewis; *Vice-Chairman*, Coun. W. Beale.

Nottingham Corporation Tramways, Beastmarket Hill, Nottingham. [Tramways, Nottingham; T.N., 225.] *General Manager & Elec. Eng.*, John Aldworth; *Traffic Supt.*, H. Morley; *Per. Way Eng.*, Arthur Brown (*City Eng.*); *Rolling Stock Supt.*, W. Boot; *Chairman Try. Com.*, Coun. R. H. Swain, J.P.; *Vice-Chairman*, Ald. F. R. Radford, J.P.

Oldham Corporation Tramways, Wallshaw Depot, Oldham. [T.A., Tramways, Oldham; T.N., 1495.] *Gen. Manager & Eng.*, Wm. Chamberlain; *Traffic Supt.*, M. Mullin; *Chairman Try. Com.*, Coun. Cheetham.

Perth Corporation Tramways, 128, High Street, Perth. [T.N., 226 & 101.] *Tramways Manager*, W. G. Snell; *Elec. & Tramways Eng.*, John Lambert; *Per. Way Eng.*, R. McKillop (*Burgh Surv.*); *Chairman Try. Com.*, Coun. Calderwood.

Plymouth Corporation Tramways, 71 & 72, Old Town Street, Plymouth. [T.N. 518, Plymouth.] *Gen. Manager*, C. R. Everson; *Elec. Eng.*, E. J. Okell; *Chairman Try. Com.*, Ald. T. Baker; *Vice-Chairman*, Coun. J. Moon.

Pontypridd Urban District Tramways, Generating Station, Treforest, Pontypridd. [T.N. 33.] *Gen. Manager and Elec. Eng.*, J. E. Teasdel; *Traffic Supt.*, A. Armstrong; *Per. Way Eng.*, W. E. Lowe (*Surveyor*); *Chairman Try. Com.*, Coun. M. L. Jones.

Portsmouth Corporation Tramways, Town Hall, Portsmouth. [T.N., 4910 Corporation.] *Gen. Manager*, W. R. Spaven; *Elec. and Per. Way Eng., and Rolling Stock Supt.*, V. G. Lironi; *Traffic Supt.*, W. Munford; *Chairman Try. Com.*, Coun. J. Timpson; *Vice-Chairman*, Ald. R. Payne.

Preston Corporation Tramways, Holmrook Road, Preston. [T.A., Corporation Tramways, Preston; T.N., 273.] *Gen. Manager and Elec. Eng.*, J. F. Simpson; *Assistant Manager and Engineer*, H. Clayton; *Chairman, Try. Com.*, Ald. J. Ormrod; *Vice-Chairman*, Coun. T. Parkinson.

Radcliffe Urban District Council Tramways, Council Offices, Radcliffe, Lancs. *Res. Eng.*, H. Wilkinson; *Per. Way Eng.*, W. L. Rothwell; *Clerk*, S. Mills; *Chairman Try. Com.*, Coun. Lund.
[These tramways are worked as part of the Bury system.]

Rawtenstall Corporation Tramways, Bacup Road, Rawtenstall. [T.N., 81.] *Gen. Manager and Elec. Eng.*, C. L. E. Stewart; *Chairman Try. Com.*, Ald. H. Coupe, J.P.; *Vice-Chairman*, Coun. J. W. Stansfield.

Reading Corporation Tramways, Mill Lane, Reading. [T.A., Tramways Manager, Reading; T.N., 330.] *Gen. Manager & Elec. Eng.*, G. F. Craven; *Chairman Try. Com.*, Ald. C. G. Field, J.P.

Rochdale Corporation Tramways, Mellor Street, Rochdale. [T.A., Tramways, Rochdale; T.N., 48.] *Gen. Manager & Eng.*, G. Webster; *Traffic Manager*, R. Bentley; *Per. Way Eng.*, H. Yarwood; *Rolling Stock Supt.*, E. Sidgwick; *Chairman Try. Com.*, Ald. Taylor.

Rotherham Corporation Tramways, St. George's Hall, Rotherham. [T.A., Tramways, Rotherham; T.N., 152 and 241.] *General Manager*, H. Jagger; *Per. Way Eng.*, T. P. Collinge; *Traffic Supt.*, W. G. Marks; *Chairman Try. Com.*, Ald. G. Gummer, J.P.; *Vice-Chairman*, Coun. Caine, J.P.

St. Helens Corporation Tramways, Town Hall, St. Helens, Lancs. *Chairman Try. Com.*, Coun. Rudd; *Vice-Chairman*, Coun. W. N. Pilkington.
[Lines worked by the New St. Helens and District Tramways Co.]

Salford Corporation Tramways, 32, Blackfriars Street, Salford. [T.A., Tramways, Salford; T.N., 5367 and 5368 Central.] *Gen. Manager*, Geo. W. Holford; *Elec. Eng.*, J. A. Robertson; *Traffic Supt.*, J. W. Blakemore; *Per. Way Supt.*, E. B. Martin; *Rolling Stock Supt.*, R. Chadwick; *Chairman Try. Com.*, Ald. H. Linsley, J.P.; *Vice-Chairman*, Coun. W. H. Barrett.

Sheffield Corporation Tramways, 8, Division Street, Sheffield. [T.A., Tramways, Sheffield; T.N., 4600.] *General Manager*, A. B. Fearnley; *Assist. Man.*, H. Watson; *Per. Way Eng.*, W. J. Hadfield; *Rolling Stock Supt.*, J. Smith; *Chairman Try. and Motors Com.*, Ald. Sir W. E. Clegg, J.P.; *Vice-Chairman*, Ald. W. C. Fenton, J.P.

Shipley Urban District Tramway, Dockfield, Shipley. [T.A., Electricity Works, Shipley; T.N., 190.] *Elec. Eng.*, Wm Redman; *Chairman Try. Com.*, H. Pitts.
[Lines leased to Bradford Corporation.]

Southampton Corporation Tramways, 161, Above Bar, Southampton. [T.A., Tramways, Southampton; T.N., 301.] *Gen. Manager*, W. T. Robson; *Boro. Elec. Engineer*, H. S. Ellis; *Traffic Manager*, C. G. Simpson; *Chairman Try. Com.*, Ald. F. A. Dunsford, J.P.

Southend-on-Sea Corporation Tramways, London Road, Southend-on-Sea. [T.N., 96.] *Gen. Manager and Elec. Eng.*, R. Birkett; *Traffic Manager*, J. T. Fayle; *Per. Way Eng.*, R. H. Dyer (*Acting Boro. Surveyor*); *Rolling Stock Supt.*, J. Dobson; *Chairman Try. Com.*, Coun. G. Radford.

Southend Pier Electric Railway, (owned and worked by Southend-on-Sea Corporation), [T.A., Piermaster, Southend; T.N., 91.] Southend-on-Sea. *Elec. Eng.*, C. R. Norton; *Acting Piermaster*, J. C. Herbert; *Chairman*, Coun. F. Britain.

Southport Corporation Tramway, 44, Chapel Street, Southport. [T.N., 116.] *Gen. Manager*, T. J. Kendrew; *Boro' Elec. Eng.*, A. S. Black; *Chairman Try. Com.*, Coun. Clayton; *Vice-Chairman*, Coun. Richardson.

South Shields Corporation Tramways, Dean Road, South Shields. [T.A., Tramways, South Shields; T.N., 157.] *Gen. Manager & Elec. Eng.*, J. C. Whiteley; *Boro. Elec. Eng.*, ———; *Chairman Try. Com.*, Ald. W. G. Wylie; *Vice-Chairman*, Coun. J. G. Winskell.

Stalybridge Hyde, Mossley, and Dukinfield Tramways and Electricity Board, Waterloo Road, Stalybridge. [T.N., 311.] *Commercial Manager*, F. Schofield; *Chief Eng.*, R. Blackmore; *Chairman Try. Com.*, Ald. R. Wood; *Vice-Chairman*, Coun. S. C. Homer.

Stockport Corporation Tramways, Mersey Square, Stockport. [T.N., 232 and 237.] *Manager*, A. T. Eardley; *Elec. Eng.*, R. Lomax; *Chairman Try. Com.*, Coun. T. W. Potts, O.B.E.; *Vice-Chairman*, Coun. C. Littler.

Sunderland Corporation Tramways, Tramway Offices, Monkwearmouth, Sunderland. [T.A., Trys. Manager, Sunderland; T.N., 948.] *Gen. Manager and Elec. Eng.*, A. R. Dayson; *Per. Way Eng.*, T. Inglis Rudman; *Chairman Try. Com.*, Ald. G. New, J.P.; *Vice-Chairman*, Coun. W. Walker, J.P.

Swindon Corporation Tramways, Electricity Works, Swindon. [T.A., Tramways, Swindon; T.N., 4.] *General Manager*, T. Medcalf; *Elec. and Mech. Eng.*, F. Newey; *Chairman Try. Com.*, Coun. Horder; *Vice-Chairman*, Coun. Stevens.

Wallasey Corporation Tramways, Seaview Road, Wallasey. [T.A., Tramways, Liscard; T.N., 1431, Liscard.] *General Manager*, R. R. Greene; *Elec. Eng.*, J. H Crowther; *Per. Way Eng.*, W. H. Travers; *Chairman Try. Com.*, Coun. F. E. Howse; *Vice-Chairman*, Coun. H. W. Griffin.

Walsall Corporation Tramway, St. Paul's Buildings, The Bridge, Walsall. [T.A., Tramways, Walsall; T.N., 238 & 559.] *Gen. Manager*, R. L. Horsfield; *Elec. Eng.*, H. A. Howie; *Per. Way Eng.*, J. Taylor (*Boro. Surveyor*); *Chairman, Try. Com.*, Ald. J. Cope; *Vice-Chairman*, Ald. J. Williams.

Walthamstow Urban District Council Tramways, Chingford Road, Walthamstow, [T.A., Tramways, Walthamstow; T.N., '20.] *Tramways Manager*, W. Murray; *Elec. Eng.*, G. R. Spurr (Priory Avenue, Walthamstow); *Per. Way Eng.*, G. W. Holmes; *Chairman Trys. Com.*, Coun. Clarke.

Warrington Corporation Tramways, Mersey Street, Warrington. [T.N., 196] *Gen. Manager*, J. Telfer; *Elec. Eng.*, F. V. L. Mathias; *Chairman Try. Com.*, Coun. Dr. G. W. Joseph; *Vice-Chairman*, Ald. J. Wilkinson.

West Bromwich Corporation Tramway, Electricity Works, West Bromwich. [T.N., 100.] *Boro. Eng.*, A. D. Greatorex; *Boro. Elec. Eng.*, W. A. Jackson; *Chairman Highways Com.*, Ald. A. G. Turley, J.P.; *Vice-Chairman*, Ald. G. Garratt.
[These tramways are leased to the South Staffs. (Lessee) Co., Ltd.]

West Ham Corporation Tramways, Greengate Street, Plaistow, London, E. [T.A., Trameurs, Plais., London; T.N., 862 and 868 East.] *General Manager*, L. Slattery; *Boro' Elec. Eng.*, J. W. Beauchamp; *Chairman Try. Com.*, Coun. Kensett.

West Hartlepool Corporation Tramways, Cleveland Road, West Hartlepool. [T.N., 6073.] *Gen. Manager & Eng.*, Chas. Burgess; *Chairman Try. Com.*, Ald. Martin; *Vice-Chairman*, Coun. Charlton.

Wigan Corporation Tramways, Market Place, Wigan; [T.N., 226.] *General Manager*, William Billington; *Traffic Supt.*, T. B. Herner; *Rolling Stock Supt., Works Manager and Eng.*, B. Hall; *Per. Way Eng.*, R. B. Donald; *Chairman Try. Com.*, Coun. A. Guest; *Vice-Chairman*, Coun. J. Walkden.

Wolverhampton Corporation Tramways, Municipal Tramway Offices, Cleveland Road, Wolverhampton. [T.N., 324.] *Gen. Manager and Engineer*, C. O. Silvers; *Boro. Elec. Eng.*, S. T. Allen; *Per. Way Eng.*, George Green; *Chairman Try. Com.*, Ald. Sir C. T. Mander, Bart., J.P.; *Vice-Chairman*, Ald. S. Craddock, J.P.

Yarmouth Corporation Tramways (See Great Yarmouth Corporation Tramways).

York Corporation Tramways, 8, Clifford Street, York. [T.N., 302]. *Gen. Manager and Elec. Eng.*, J. W. Hame; *Traffic Supt.*, J. W. Horton; *Per. Way Eng.*, F. W. Spurr (City Surveyor); *Chairman Try. Com.*, Ald. S. W. Meyer; *Vice-Chairman*, Coun. W. H. Sessions.

COMPANY TRAMWAYS

Aberdeen Suburban Tramways Company, 15, Golden Square, Aberdeen. [T.A., Judicial, Aberdeen; T.N., 447.] *Manager & Per. Way Eng.*, A. Wilkie; *Sec.*, G. Duncan; *Chairman*, James Mearns; *Directors*, Dr. Christie, Jas. Sellar.

Airdrie and Coatbridge Tramways Company, Tramway Depôt, Main Street, Coatbridge [T.N., 105], and Manchester Hotel, London, E.C. *Gen. Manager*, A. Robertson; *Sec.*, P. N. Gray; *Chairman*, W. L. Madgen; *Directors*, H. S. Day, A. C. Miles, G. J. Somerville.

Barnsley and District Electric Traction Company, Ltd., Car Depot, Sheffield Road, Barnsley. [T.A., Tramways, Barnsley; T.N., 159.] *General Manager*, W. E. Nicoll; *Acting Sec.*, P. N. Gray; *Chairman*, E. Garcke; *Directors*, Col. Sir Thomas Pilkington, Bart., E. A. Paris.

Barrow-in-Furness Tramways, Salthouse Road Depot, Barrow, and Electrical Federation Offices, Manchester Hotel, London, E.C. [T.A., Tramways, Barrow; T.N., 125.] *Manager*, J. R. Groves; *Sec.*, F. J. Cursons; *Acting Sec.*, J. S. Bowker; *Chairman*, C. G. Tegetmeier; *Directors*, J. V. Kitchener, E. R. Soames.

Bath Electric Tramways Company, Ltd., Walcot Street, Bath, and 119-125, Finsbury Pavement, London, E.C. [T.A., Trams, Bath; T.N., 1214.] *Gen. Manager and Eng.*, W. E. Hardy; *Traffic Supt.*, E. Seckington; *Sec.*, H. J. Almond; *Chairman*, J. B. Hamilton; *Directors*, H. F. Clutterbuck, E. H. R Trenow, A. A. C. Swinton.

Bessbrook and Newry Tramway Company, Bessbrook, Co. Armagh. [T.A., Tramways, Bessbrook.] *Manager*, M. Hamilton; *Eng.*, H. Dowell *Chairman*, J. N. Richardson; *Directors*, C. H. Richardson, R. T. Scott, T W Richardson, T. McGreggor Greer.

Birmingham District Power and Traction Company, Power Station, Downing Street, Smethwick, and Manchester Hotel, London, E.C. [T.A., Power Station, Smethwick; T.N., 65 Smethwick.] *Gen. Manager*, W. G. Bond; *Secretary*, B. Kingsford; *Chairman*, C. Shirreff Hilton; *Directors*, J. A. Lycett, W. L. Madgen, S. R. Blundstone, R. J. Howley.

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ELECTRIC TRAMWAYS IN THE UNITED KINGDOM

Blackpool and Fleetwood Tramroad Company, Ltd., Bispham, near Blackpool. [T.A., Cameron, Blackpool; T.N., 121.] *General Manager and Secretary*, J. Cameron; *Elec. Eng.*, A. Cameron; *Chairman*, John Greenwood; *Directors*, R. H. Prestwich, R. B. Barningham, R. S. Boddington, G. Richardson, G. Readman.

Blackpool and Fylde Light Railway Company, 5, Clifton Street, Blackpool. (No appointment of engineer or officials yet made.) *Secretary*, R. Bibby; *Chairman*, John Greenwood; *Directors*, T. Fisher, J.P., John Platt, J.P., W. Hardman, J.P., R. H. Mabbott.

Blackpool, St. Anne's, and Lytham Tramways Company, Ltd., Squires Gate, and 30, Birley Street, Blackpool. [T.N., 327 and 23]. *Gen. Manager and Elec. Eng.*, H. W. Laing; *Traffic Manager*, G. W. Wood; *Rolling Stock Supt.*, J. Partington; *Secretary*, Chas. E. Riding; *Chairman*, G. Nicholson; *Directors*, T. M. Smith, T. Preston.

Brighton Beach Electric Railway, Madeira Road, Brighton. [T.A., Volk, Brighton; T.N., 14 P.O.] *Manager and Eng.*, Magnus Volk; *Traffic Superintendent*, Miss Barton; *Per. Way Eng.*, J. Barker; *Secretary*, A. Volk; *Chairman*, Magnus Volk; *Directors*, M. H. Volk, B. W. Symonds, A. Volk.

Bristol Tramways and Carriage Company, Ltd., Clare Street House, Bristol. [T.A., Cab, Bristol; T.N., 74 & 3074 Nat.] *Manager*, Colonel S. E. Smith; *Assist. Manager*, W. H. Stradling; *Electrical Engineer*, W. Nairn; *Permanent Way Engineer*, G. T. C. Edwards; *Secretary*, H. F. Cooper; *Chairman*, S. White, J.P.; *Directors*, W. G. Verdon Smith (*Managing*), J. H. Howell, J.P., Sir G. Stanley White, Bart., S. E. Baker, Chas. Challenger.

British Electric Traction Company, Ltd., Manchester Hotel, London, E.C. E. Garcke (*chairman*); *Directors*, C. Shirreff, B. Hilton, W. L. Madgen, Sir Charles Ollivant, A. Shepherd, C. G. Tegetmeier, P. D. Tuckett; *Manager*, C. H. Dade; *Secretary*, T. Bower; *Accountant*, C. Walmsley.

This company is interested in the following tramways, particulars of which are given under their respective names:

Airdrie & Coatbridge.
Barnsley & District.
Barrow-in-Furness.
Birmingham & District Power & Traction Co.
Birmingham & Midland
Dudley, Stourbridge, & District.
South Staffordshire.
Wolverhampton Dist.
Devonport & District.
Gateshead & District.
General Elec. Tramways.
Gravesend & Northfleet.
Greenock & Port Glasgow.
Jarrow & District.
Kidderminster & District.
Merthyr.
Middleton.
Oldham, Ashton, & Hyde.
Peterborough.
Potteries.
Rothesay.
Sheerness & District.
Swansea.
Taunton.
Tynemouth & District.
Weston-super-Mare & District.
Worcester.
Wrexham & District.
Yorkshire (Woollen Dist.)

Burton and Ashby Light Railway, Power Station, Swadlincote, nr. Burton-on-Trent. [T.A., Toulmin, Swadlincote; T.N., 1.] *Manager and Eng.*, Jas. Toulmin; *Secretary*, W. N. Bancroft; *Chairman*, G. Murray Smith.

[The line is owned and worked by the Midland Railway Company.]

Camborne and Redruth Tramways, Elec. Works, Carn Brea, R.S.O., Cornwall. [T.N., 3, Camborne.] (Owned by Urban Elec. Supply Co.) *Manager and Eng.*, L. A. Hards; *Sec.*, C. H. Jones; *Chairman*, P. D. Tuckett; *Directors*, E. Charrington, H. B. Grotian, Sir Douglas Owen.

Carlisle Tramways Company, Ltd., City of, Depot and Offices, London Road, Carlisle. [T.A., Tramways, Carlisle; T.N., 0180.] *Engineer and Manager*, E. W. Sleight.

Chatham and District Light Railways Company, Luton Road, Chatham, and 83, Cannon Street, London, E.C. [T.A., Tramways, Chatham; T.N., 51.] *General Manager*, W. Jensen; *Assist. Manager*, A. J. Bousfield; *Secretary*, A. Clements; *Chairman*, A. R. Monks; *Directors*, H. C. Levis, J. F. Nauheim, W. B. H. Martindale.

Cheltenham and District Light Railway Company, Cheltenham. [T.N., 341.] *Chairman*, A. R. Holland; *Directors*, A. H. Beatty, W. Shearer, H. L. Williams, A. S. Guinness, H. J. McCormick; *Sec.*, Wm. C. Bryden, C.A., 66, Queen Street, London, E.C.; *Local Eng. and Manager*, Henry J. McCormick, Dalkeith, Gloucester Road, Cheltenham.

Clontarf and Hill of Howth Tramroad Company, 39, Dame Street, Dublin. [T.A., c/o Railways, Dublin; T.N., 917.] *Secretary*, J. P. Chapman; *Chairman*, W. L. Murphy; *Directors*, E. Anderson, J. J. Dudley.

Cork Electric Tramways and Lighting Company, Ltd., Albert Street, Cork. [T.A., Tramways, Cork; T.N., 78 and 535.] *Manager and Engineer*, H. H. Nalder; *Traffic Manager*, H. G. Whiting; *Per. Way Engineer*, H. Mack; *Secretary*, A. Clements; *Chairman*, A. R. Monks; *Directors*, E. Anderson, W. M. Murphy, Capt. W. Martindale, H. C. Levis.

Dartford Urban District Council Light Railways. Car Depot, Priory Road, Dartford. [T.N., 31 Dartford.] (Leased to and worked by Bexley Urban District Council, Broadway, Bexleyheath, Kent).

Devonport and District Tramways Company, Electrical Federation Offices, Manchester Hotel, London, E.C. *Secretary*, S. M. Wright; *Acting Sec.*, P. N. Gray; *Chairman*, C. S. B. Hilton; *Directors*, J. S. Raworth, E. R. Soames, C. G. Tegetmeier, R. J. Sutcliffe.

[This Company's undertaking has been sold to Plymouth Corporation.]

Dewsbury, Batley, and Birstall Tramways Company, Ltd., Electrical Federation Offices, Manchester Hotel, London, E.C.

[Lines worked by Yorkshire (Woollen District) Electric Tramways, Ltd., *q.v.*]

Dewsbury and Ossett Corporation and Soothill Nether Urban District Council Tramways, (Lessees: The National Elec. Construction Co., Ltd., 62 and 63, Queen Street, London, E.C.) [T.A., Overhauled, London; T.N., 6616 and 6617 City.] *Manager*, W. McGibbon.

Douglas—Ramsey (The Manx Elec. Rly. Company), 1, Strathallan Crescent, Douglas. (See Manx Electric Railway Company).

Douglas Southern Electric Tramways, Ltd., Marine Drive, Douglas, Isle of Man, and 24, Brazennose Street, Manchester. [T.A., Traffic, Douglas.] *Manager and Eng.*, R. Orton; *Sec.*, J. E. Sharples; *Chairman*, T. J. Hutchinson; *Directors*, I. E. Winslow, E. A. Hopkins.

Dublin and Lucan Electric Railway Company, 15, Conyngham Road, Dublin. [T.A., Lucan Tramway, Dublin; T.N. 2282, 4005 and 4006 Dublin, and 5 Lucan.] *Manager, Elec. Eng., and Sec.*, D. McDowall Grosart, J.P.; *Chairman*, J. W. Hill, J.P.; *Directors*, E. Anderson, J.P., A. B. Coyle, J.P., G. V. Murphy, J. R. Dillon.

Dublin United Tramways Company (1896), Ltd., 9, Upper Sackville Street, Dublin. [T.A., Tramways, Dublin; T.N., 58 and 59.] *Gen. Manager*, G. Marshall Harriss; *Elec. Eng.*, R. Tanham; *Con. Eng.*, H. F. Parshall; *Per. Way Eng.*, P. F. O'Sullivan; *Secretary*, W. McHugh; *Chairman*, W. M. Murphy, J.P.; *Directors*, Joseph Mooney, J.P., Rt. Hon. L. A. Waldron, P.C., William Hewat.

Dudley, Stourbridge and District Electric Traction Company, Ltd. (Section of The Birmingham and Midland Tramways Joint Committee), Power Station, Downing Street, Smethwick, Brierley Hill, Staffs., and Manchester Hotel, London, E.C. [T.N., 65 Smethwick.] *General Manager*, W. G. Bond; *Secretary*, E. H. Woodhall; *Chairman*, S. R. Blundstone; *Directors*, J. A. Lycett, R. J. Howley, B. Kingsford (*Acting Sec.*)

Dumbarton Burgh and County Tramways Company, Tramway Depot, Dumbarton, and 28, Rutland Street, Edinburgh. [T.A., Tramways, Dumbarton; T.N., 119.] *Gen. Manager and Elec. Eng.*, J. P. McMahon; *Secretary*, A. Dishart; *Chairman*, G. Balfour; *Directors*, K. Sanderson, K. A. Scott Moncrieff.

Dundee, Broughty Ferry & District Tramways Company, Milton, Monifieth, N.B. [T.N., 24 Monifieth.] *Gen. Manager and Engineer*, George Brander; *Secretary*, E. Cowan; *Chairman*, George Balfour; *Directors*, Edward Cowan, David Hynd.

Dunfermline and District Tramways Company, Tramway Depot, Cowdenbeath, Fife, and 8, New Row, Dunfermline. *Manager and Engineer*, J. H. Shepherd; *Secretary*, G. A. Nicolson; *Cons. Engs.*, Hawtayne & Zeden; *Directors*, Wm. Low, G. Balfour (*managing*), K. Sanderson, D. Hynd.

Falkirk & District Tramways Company, Larbert Road, Larbert, Stirlingshire. [T.A. Tramways Co., Falkirk; T.N., 154 Falkirk.] *Gen. Manager and Engineer*, D. Hays; *Chairman*, G. M. Brown; *Directors*, A. W. Tait, R. Hunter, G. Balfour, C. D. Geddes.

Felixstowe Pier Railway, Felixstowe. (The Coast Development Corporation, Ltd.) *Elec. Eng.*, E. A. Lambert.

Gateshead and District Tramways Company, Tramway Depôt, Sunderland Road, Gateshead, and Electrical Federation Offices, Manchester Hotel, London, E.C. [T.A., Tramway Depôt, Gateshead; T.N., 125 & 408 Gateshead.] *General Manager*, William Morrison; *Secretary*, H. W. Davis; *Chairman*, H. S. Day; *Directors*, H. A. Stagg, C. R. Greene, J.P., Judge L. A. Atherley-Jones, K.C.

Giant's Causeway and Portrush Electric Tramway Company, Portrush. *Manager & Sec.*, W. McCurdy; *Elec. Eng.*, W. A. Traill; *Chairman*, J. S. Moore; *Directors*, A. B. Stuart, W. A. Traill.

Glossop Tramways, Electricity Works, Glossop (owned by the Urban Electric Supply Co.) [T.N., 31, Glossop.] *Manager and Res. Eng.*, C. E. Knowles; *Rolling Stock Supt.*, T. L. Podmore; *Secretary*, C. H. Jones; *Chairman*, P. D. Tuckett; *Directors*, E. Charrington, F. E. Gripper, H. B. Grotrian, D. Owen.

Gosport and Fareham Tramways, Tramways and Lighting Office, Gosport, Hants., and Moorgate Station Chambers, London, E.C. [T.A., Tramways, Gosport; T.N., 3, Post Office, Gosport.] *Eng. and Manager*, J. Fereday Glenn; *Sec.*, J. Barber Glenn; *Chairman*, A. Beattie, J.P., D.L.; *Directors*, J. Barber Glenn (*managing*), S. Hern.

Gravesend & Northfleet Electric Tramways, Ltd., Tramway Depot, Northfleet, Kent, and Manchester Hotel, London, E.C. [T.N., 958, Gravesend.] *Manager*, J. Dobson; *Sec.*, H. C. Walter; *Acting Sec.*, J. S. Bowker; *Chairman*, E. Garcke; *Directors*, W. L. Madgen, P. N. Gray, W. S. Wreathall.

Great Crosby Tramways, 31, James Street, Liverpool.

[This tramway is worked by the Liverpool Overhead Railway Company.]

Great Grimsby Street Tramway Co., Southampton House, Cleethorpes, and Moorgate Station Chambers, London, E.C. [T.A., Blanco, Cleethorpes; T.N., 16.] *Manager and Eng.*, H. L. White; *Elec. Eng.*, H. O. White; *Managing Director and Secretary*, J. B. Glenn; *Chairman*, A. Beattie, J.P., D.L.; *Director*, S. Hern.

Greenock and Port Glasgow Tramways Company, Ladyburn, Greenock, and Manchester Hotel, London, E.C. [T.A., Tramways, Greenock; T.N., 562]. *Manager*, A. Robertson; *Secretary*, P. N. Gray; *Chairman*, W. L. Madgen; *Directors*, G. J. Somerville, A. C. Miles, H. S. Day.

Guernsey Railway Company, Ltd., Hougue-à-la-Perre, Guernsey. *Manager and Elec. Eng.*, Arthur G. Bird; *Sec.*, J. de Mouilpied; *Chairman*, G. F. Peek; *Directors*, W. D. Murdoch, J. B. Collings, Q. Le Pelley, T. W. Palmer.

Hampshire Light Railway (Electric) Company, Ltd., Moorgate Station Chambers, London, E.C. *Secretary*, J. B. Glenn; *Chairman*, A. Beattie, J.P.; *Directors*, J. Barber Glenn (*managing*), S. Hern.

[This company works the Portsdown and Horndean Light Railway.]

Hastings Tramways Company, Ltd., Beaufort Road, Silverhill, St. Leonards-on-Sea, and 1, Queen Victoria Street, London, E.C. [T.A., Tramways, Hastings, and Ensbrine, London; T.N., 90 Hastings, and 3465, City]. *General Manager and Elec. Eng.*, W. Vincent Edwards; *Secretary*, W. R. Elston; *Chairman*, G. Kitchen; *Directors*, J. C. Williamson, Dr. Moody.

Imperial Tramways Company, Ltd., Clare Street House, Bristol. *Secretary*, F. H. Withers; *Manager*, F. Freshwater; *Chairman*, S. White, J.P.; *Directors*, W. G. Verdon Smith (*Managing*), J. H. Howell, Sir G. Stanley White, Bart.

Isle of Thanet Electric Tramways and Lighting Company, Ltd., St. Peter's, Kent, and Moorgate Station Chambers, London, E.C. [T.A., Tramways, St. Peters, Kent; T.N., 29 Broadstairs]. *Gen. Manager and Elec. Eng.*, J. A. Forde; *Traffic Supt.*, ————; *Secretary*, J. Barber Glenn; *Chairman*, A. R. Monks; *Directors*, Lord Arthur Butler, W. M. Murphy, H. Brown.

Jarrow and District Electric Traction Company, Ltd., Electrical Federation Offices, Manchester Hotel, London, E.C. [T.A., Jarrow, c/o Tramway, London; T.N., 2686 Holborn.] *Traffic Manager*, G. McClelland; *Secretary*, C. W. Francis; *Acting Sec.* H. A. Stagg; *Chairman*, G. J. Somerville; *Directors*, W. Morrison (*managing*), H. S. Day.

Kidderminster & District Electric Lighting and Traction Co., Ltd., Kidderminster, and Manchester Hotel, London, E.C. [T.N., 108]. *General Manager*, W. G. Bond; *Secretary*, B. Kingsford; *Chairman*, E. Garcke; *Directors*, J. A. Lycett, H. S. Day, W. L. Madgen.

Kinver Tramway, Kinver, and Electrical Federation Offices, Manchester Hotel, London, E.C., *q.v.*, Dudley, Stourbridge, and District Elec. Traction Co., Ltd.

Lanarkshire Tramways Company, Edinburgh Road, Motherwell, N.B., and 83, Cannon Street, London, E.C. [T.A., Tramways, Motherwell; T.N., 64.] *Gen. Manager and Eng.*, G. F. Moller; *Elec. Eng.*, E. H. Glennie; *Per. Way Eng.*, R. Foster; *Traffic Supt.*, J. L. White; *Sec.*, A. Clements; *Chairman*, A. R. Monks; *Directors*, Sir B. Cunard, H. C. Levis, W. H. Whaite, G. Franklin, J. F. Nauheim.

Lancashire United Tramways Limited, Atherton, Lancs. [T.A., Tramways, Atherton; T.N., 36, Atherton.] *Gen. Manager and Engineer*, E. H. Edwardes; *Secretary*, H. P. Conibear; *Chairman*, Hon. Sir A. Stanley G.B.E., M.P.; *Directors*, J. M. Henderson, M.P., R. Watson, J.P., A. Adam, J. S. Austen.

Liverpool and Prescot Light Railway.—This line, which with the St. Helens Tramways forms the connecting link between the City of Liverpool and South Lancashire Tramways, is owned and worked by the Lancashire United Tramways, Ltd.

Liverpool Overhead Railway Company, 31, James Street, Liverpool. [T.A., Motor, Liverpool; T.N., 5463 Central.] *Gen. Manager and Eng.*, E. J. Neachell; *Secretary*, H. G. Alexander; *Chairman*, H. C. Woodward; *Directors*, J. E. Anderson, G. D. Killey, J. U. Hodgson, M. H. Makwell.

Llandudno and Colwyn Bay Electric Railway, Limited, Tramway Depôt, Rhôs-on-Sea, Colwyn Bay, and Basildon House, Moorgate Street, London, E.C. *Gen. Manager*, Alex. G. Balfour; *Secretary*, A. W. R. Lovering; *Directors*, G. Balfour, A. W. Tait, T. Stoker.

Llanelly and District Electric Lighting and Traction Company, Ltd., Llanelly, and 66, Queen Street, London, E.C. *Engineer and Manager*, J. E. Stewart; *Secretary*, W. C. Bryden; *Chairman*, A. R. Holland; *Directors*, A. V. Anderson, M. A. Edwards, A. H. Beatty.

London United Tramways Ltd., Electric Railway House, Broadway, Westminster, London, S.W. [T.N., 6800, Victoria.] *Managing Director*, J. Devonshire; *Secretary*, A. L. Barber; *Gen. Manager*, C. J. Spencer; *Engineer*, A. V. Mason; *Traffic Supt.*, J. B. Mackinnon; *Chairman*, W. M. Acworth; *Directors*, Rt. Hon. Viscount Knutsford, F. V. Schuster, W. C. Burton, H. A. Vernet.

Luton Corporation Tramways (leased to and worked by Balfour, Beatty & Co., Ltd., 22a, College Hill, London, E.C.), Tramway Offices, Park Street, Luton. [T.N., 230.] *Engineer and Manager*, A. E. Wray.

Mansfield & District Light Railway Co., Sutton Road, Mansfield, and 66, Queen Street, London, E.C. [T.A., Cars, Mansfield, T.N., 107.] *Eng. and Manager*, C. R. Tattam; *Secretary*, W. C. Bryden; *Chairman*, A. R. Holland; *Directors*, W. J. Chadburn, A. H. Beatty, G. Balfour, C. R. Walker.

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ELECTRIC TRAMWAYS IN THE UNITED KINGDOM

Manx Electric Railway Company, Ltd., 1, Strathallan Crescent, Douglas, Isle of Man, and 3, Finch Lane, London, E.C. [T.A., Electric, Douglas, Man.; T.N., 61.] *Gen. Manager & Eng.*, F. Edmondson; *Secretary*, J. Featherston; *Chairman*, Sir W. H. Vaudrey; *Directors*, B. E. Greenwell, E. Remnant, C. A. Huni.

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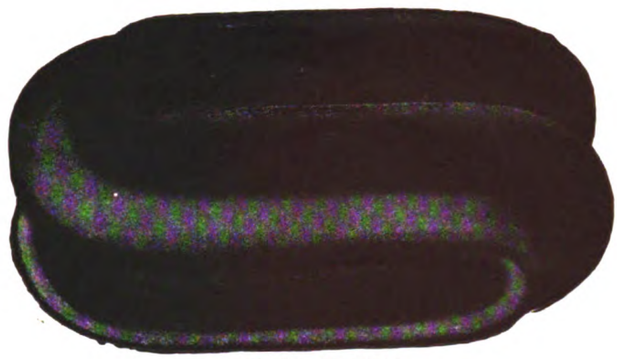

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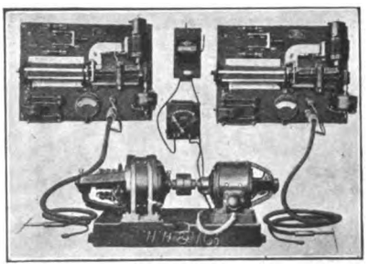

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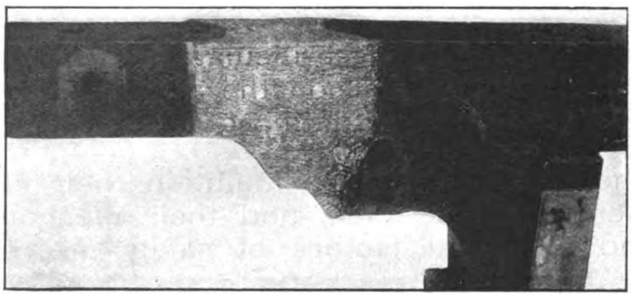

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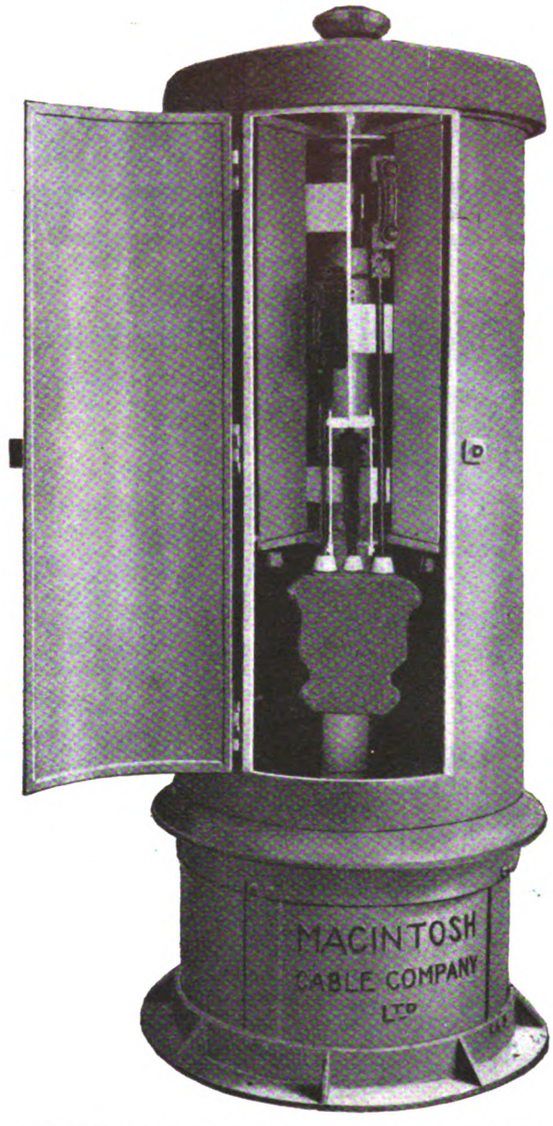

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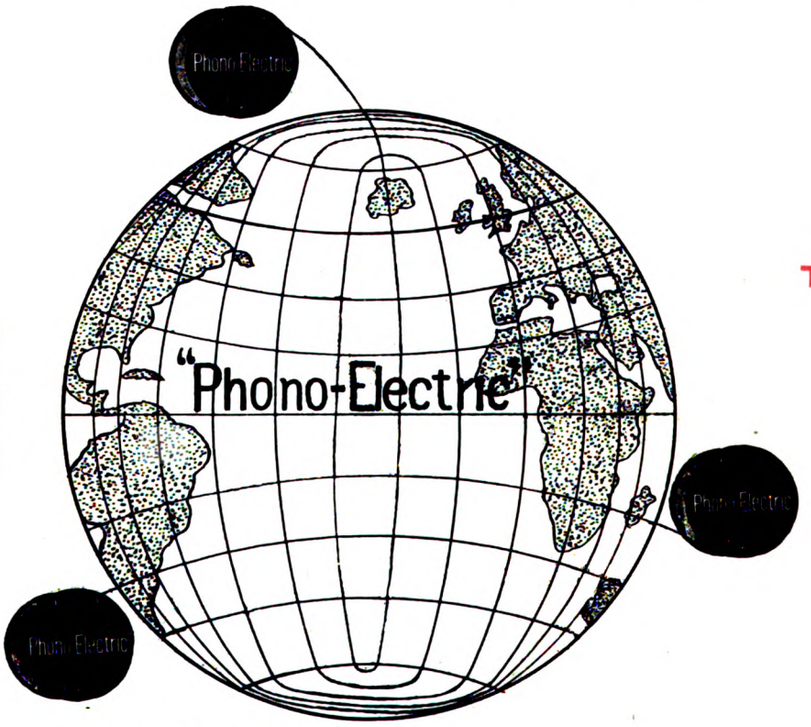

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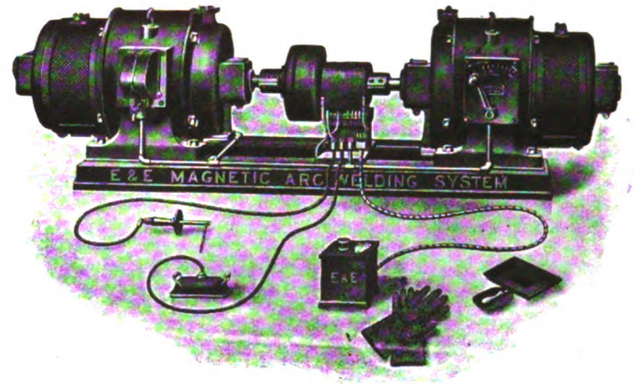

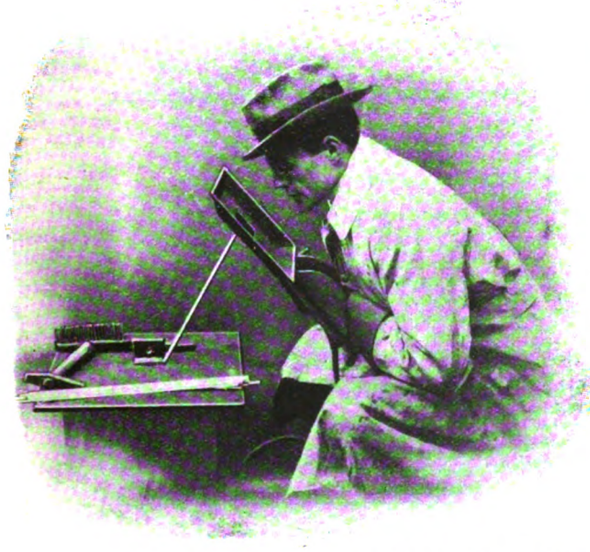

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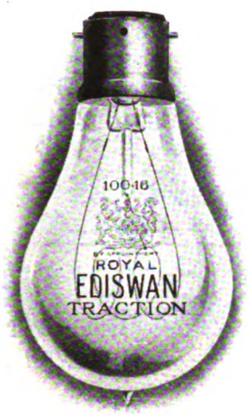

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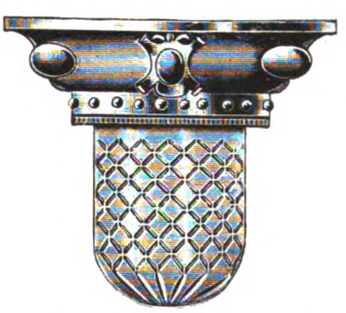

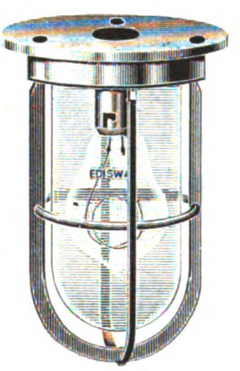

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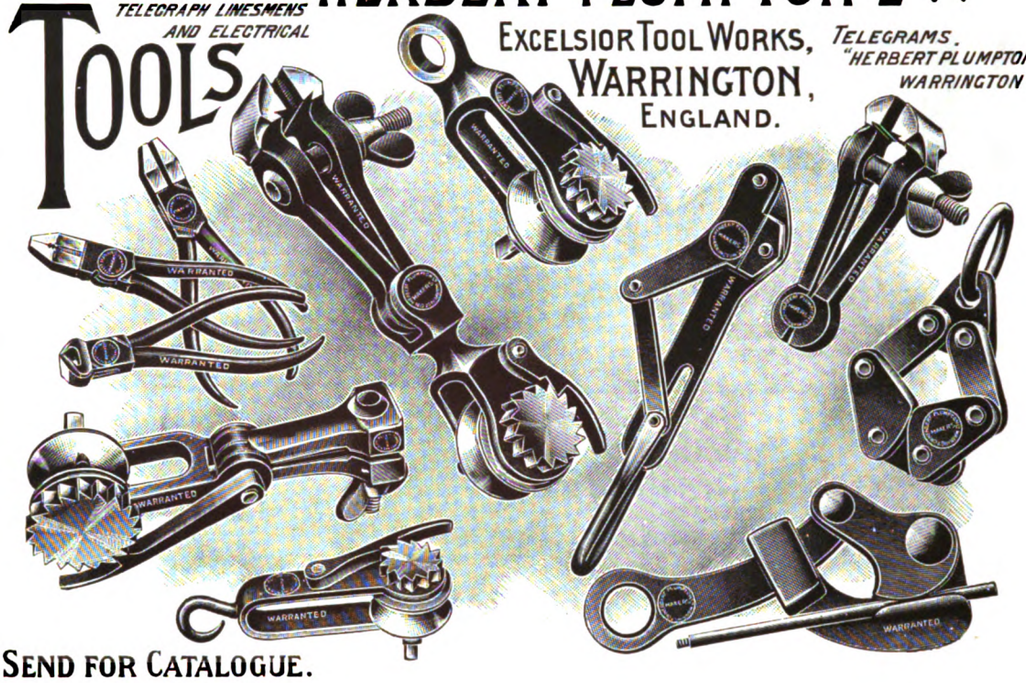

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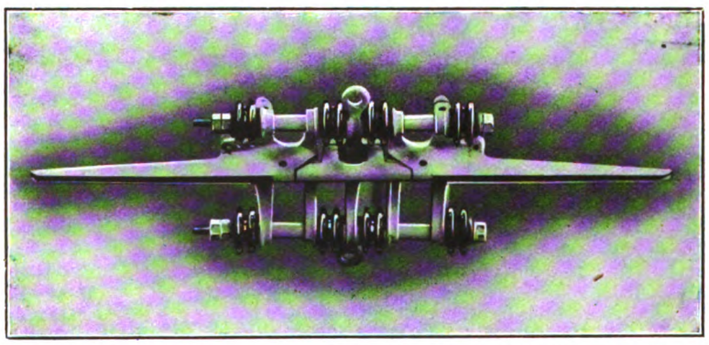

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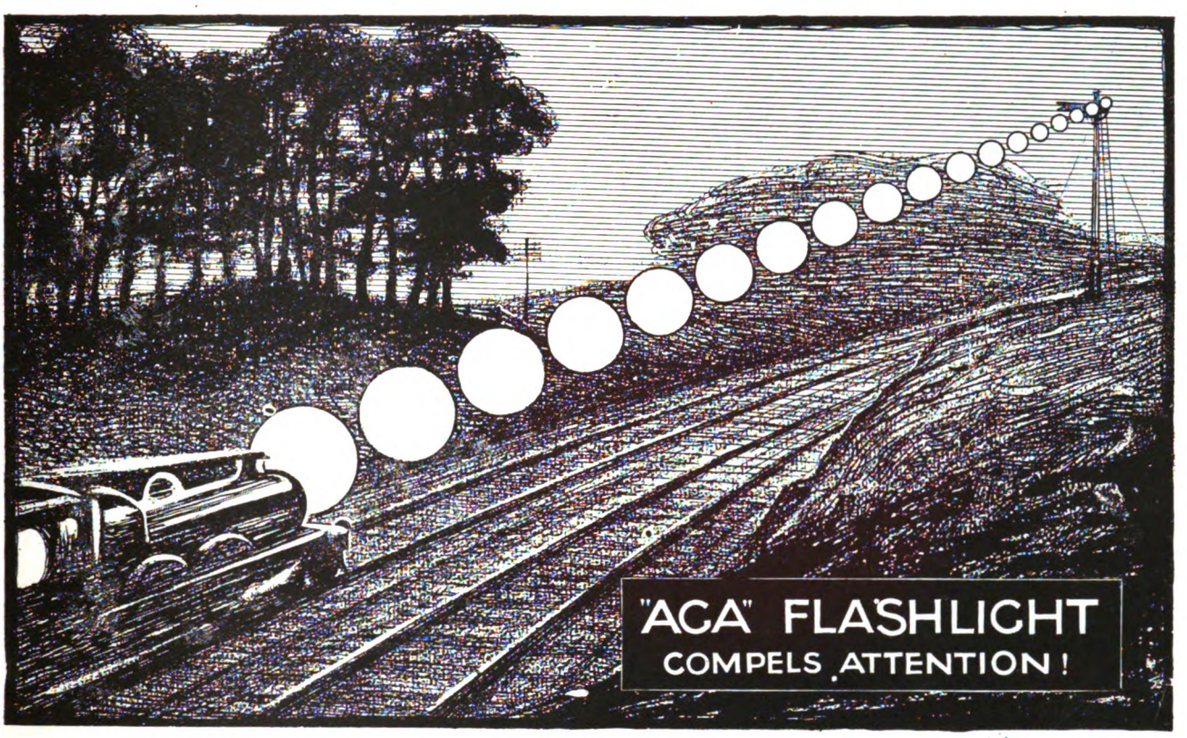

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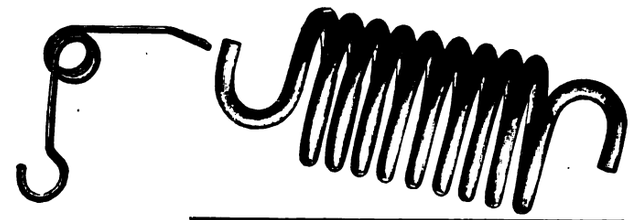

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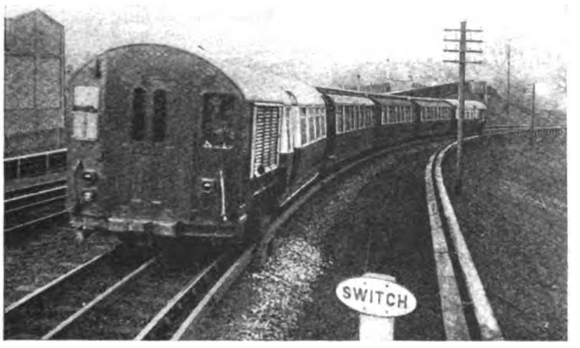

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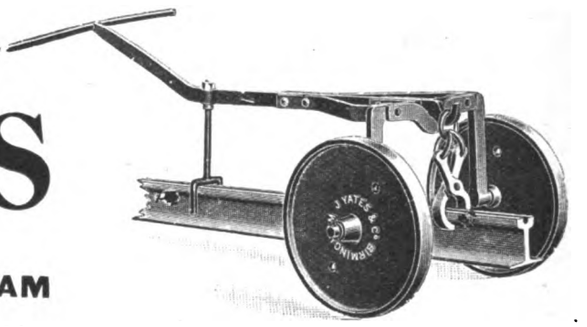

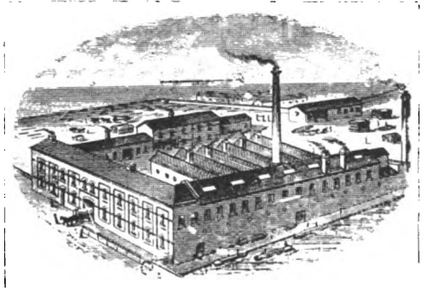

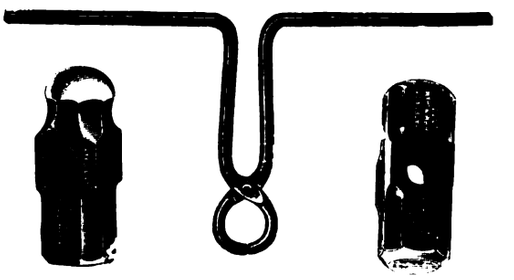

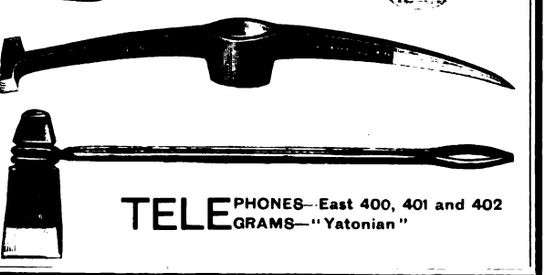

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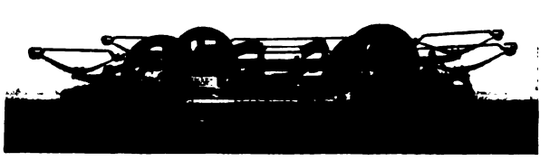

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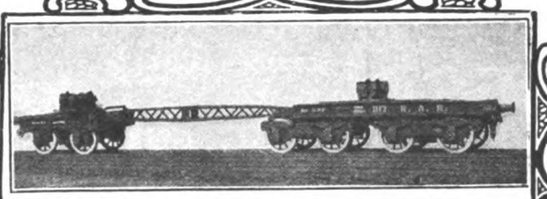

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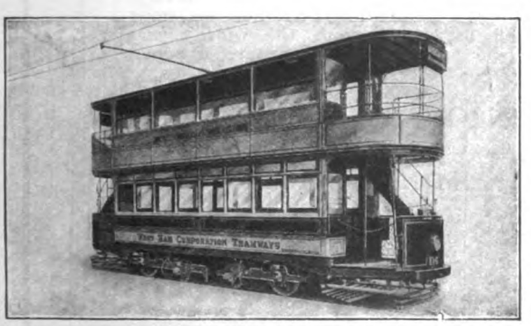

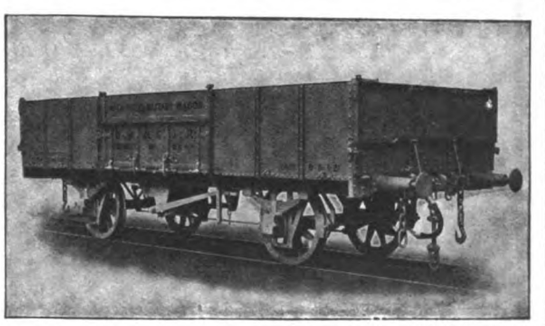

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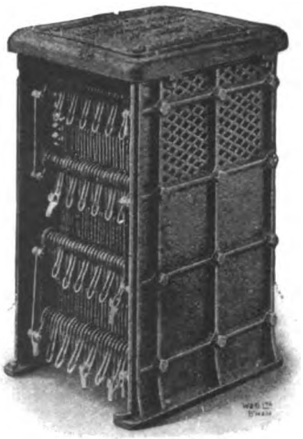

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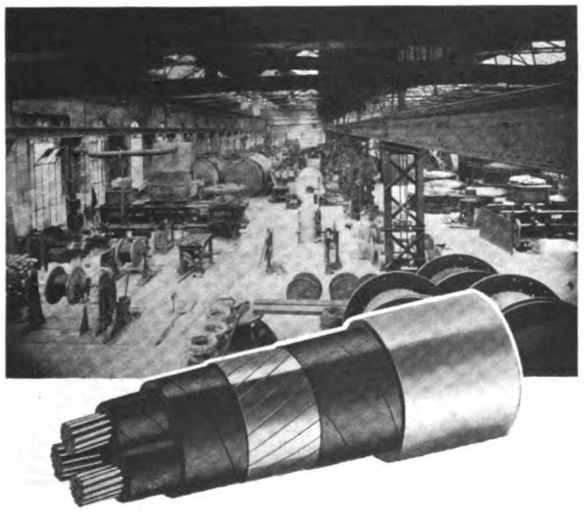

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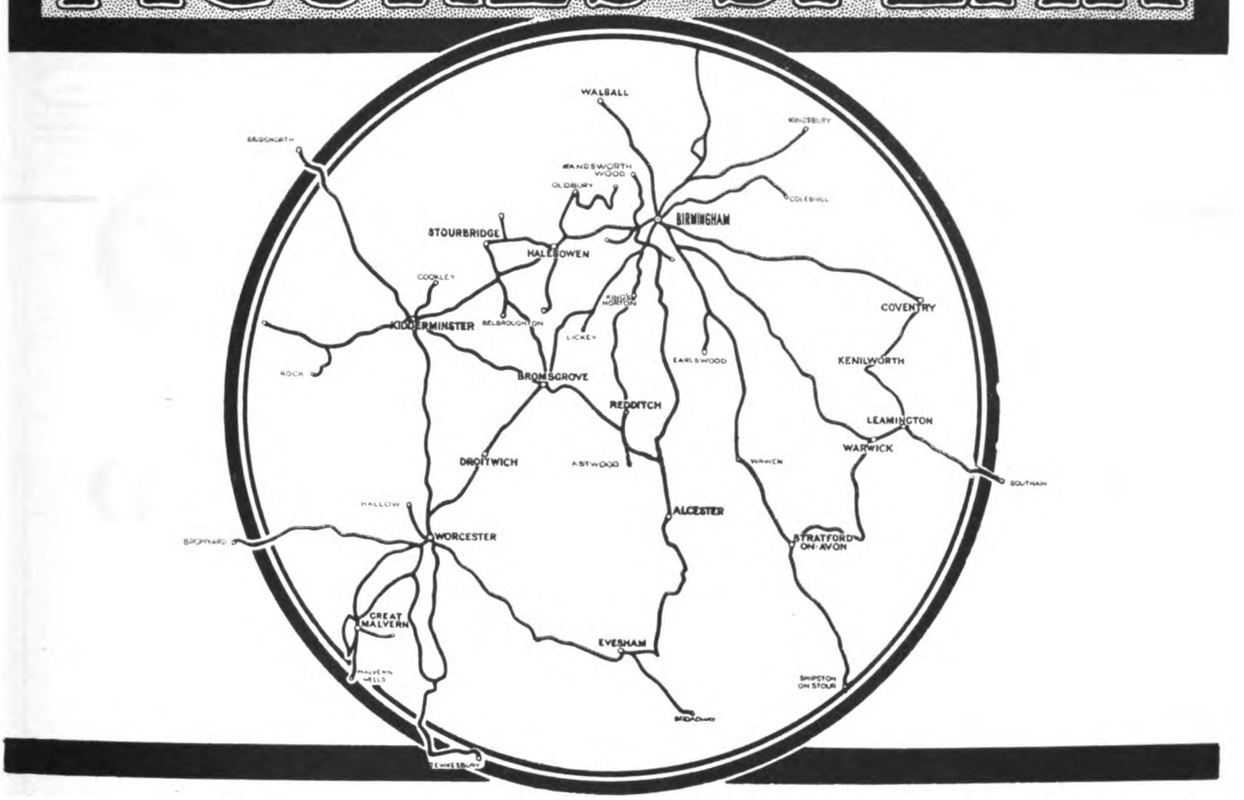

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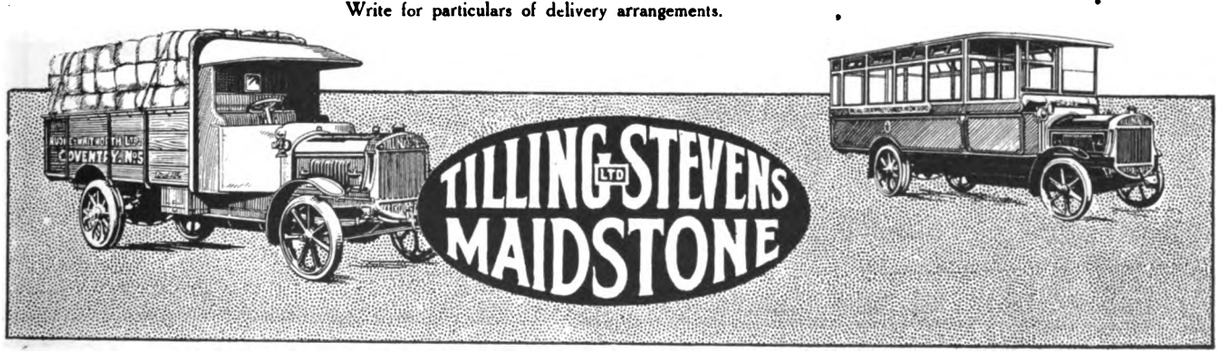

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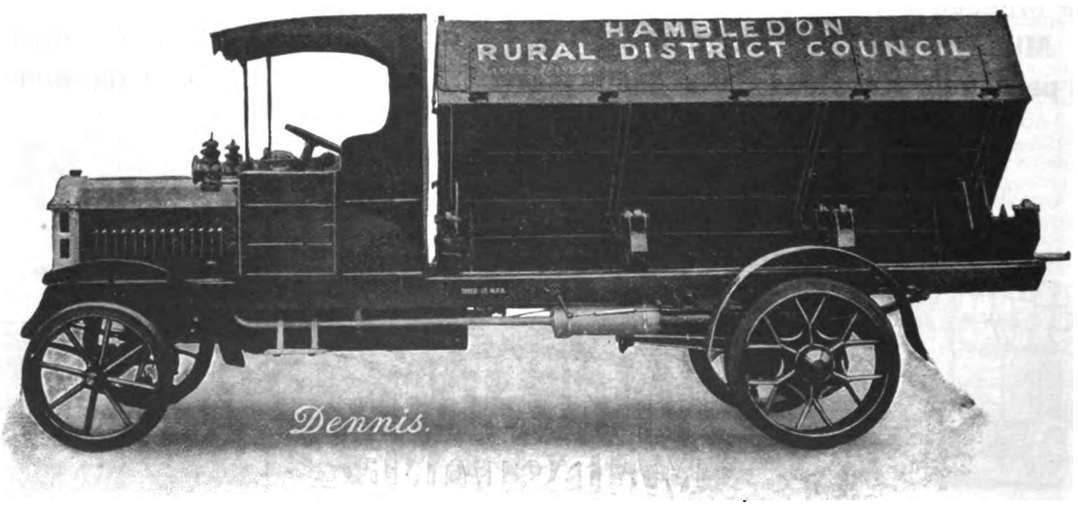

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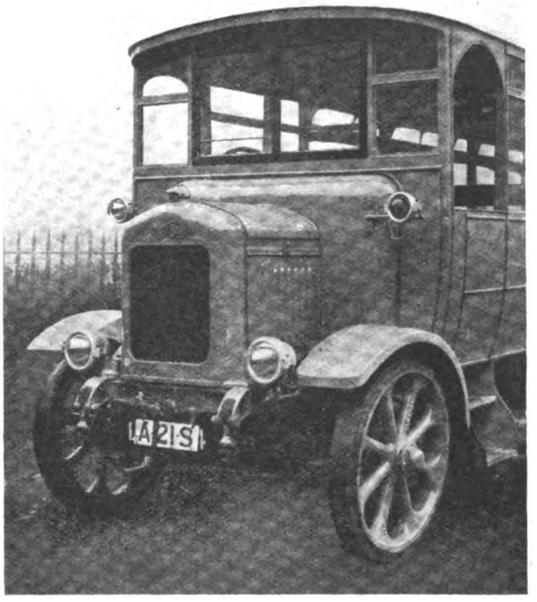

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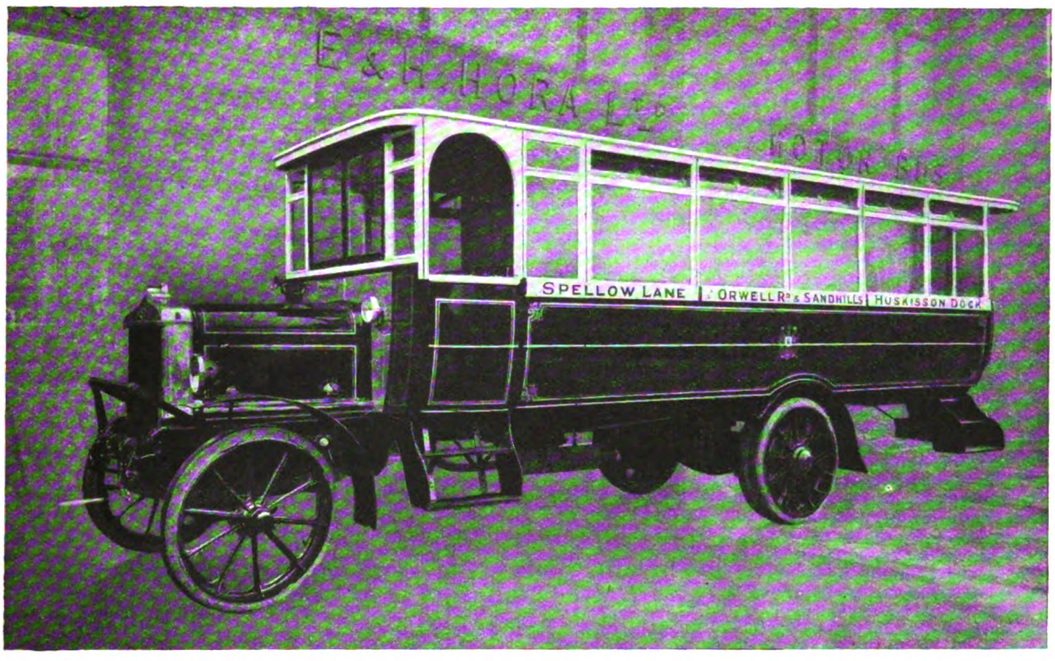

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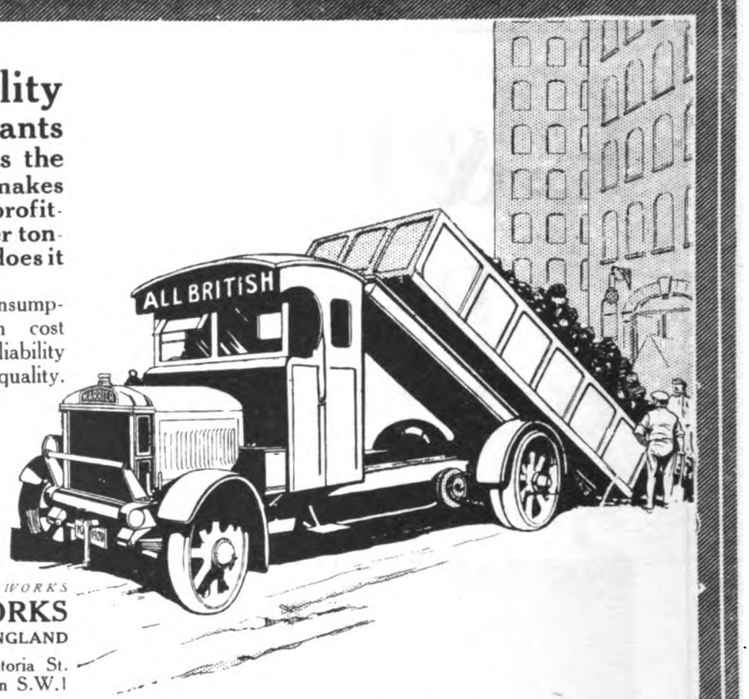

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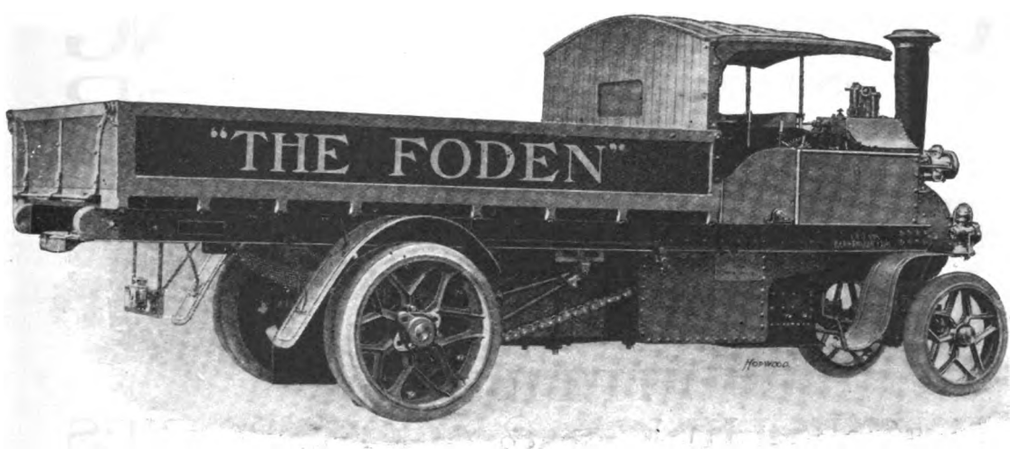

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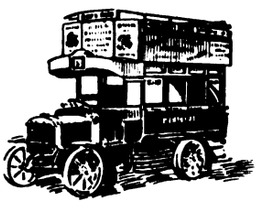

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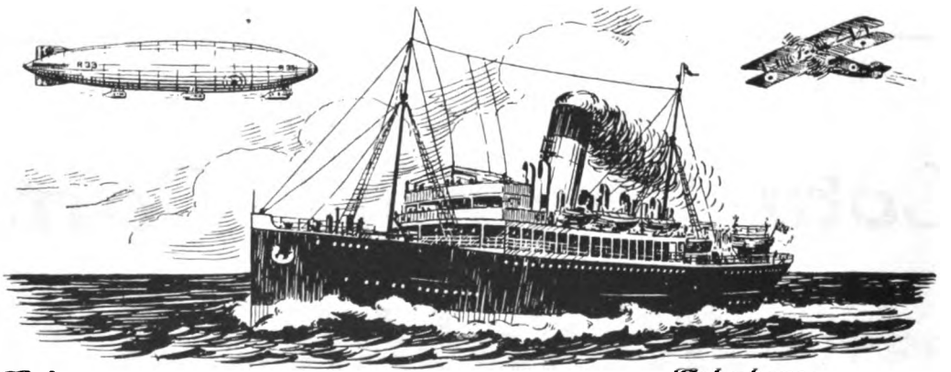

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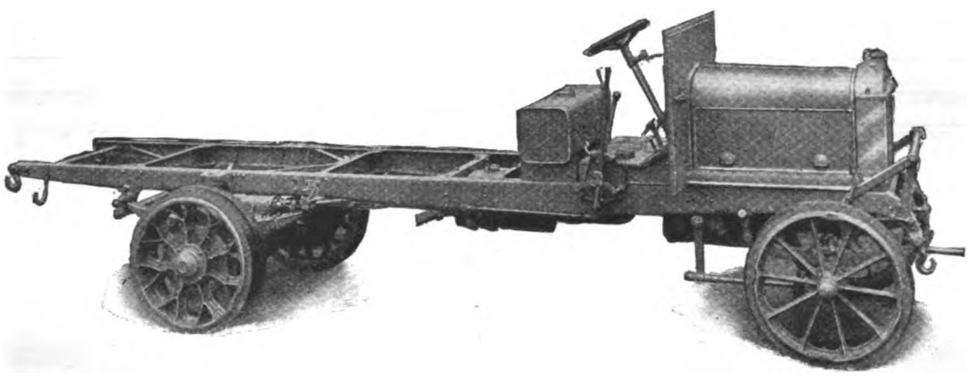

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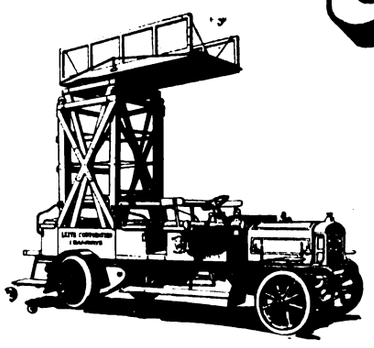

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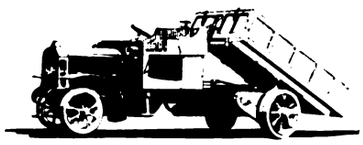

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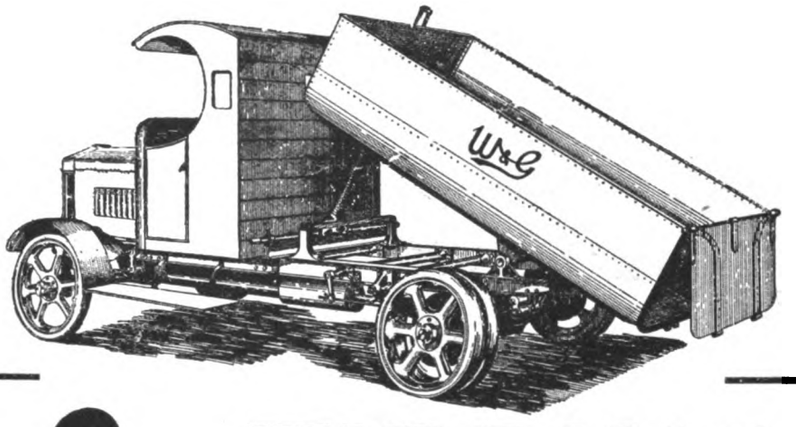

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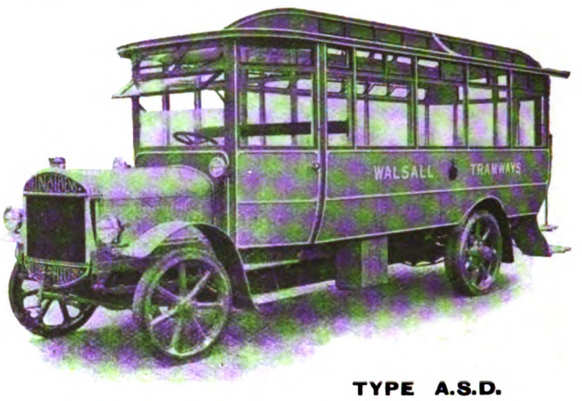

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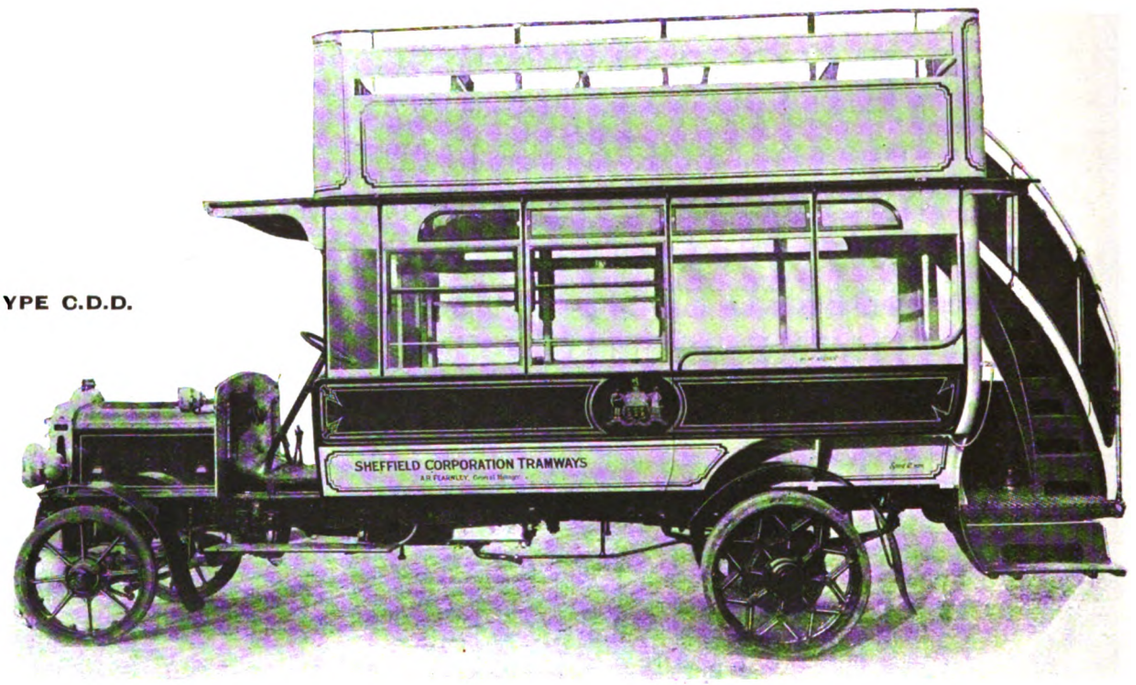

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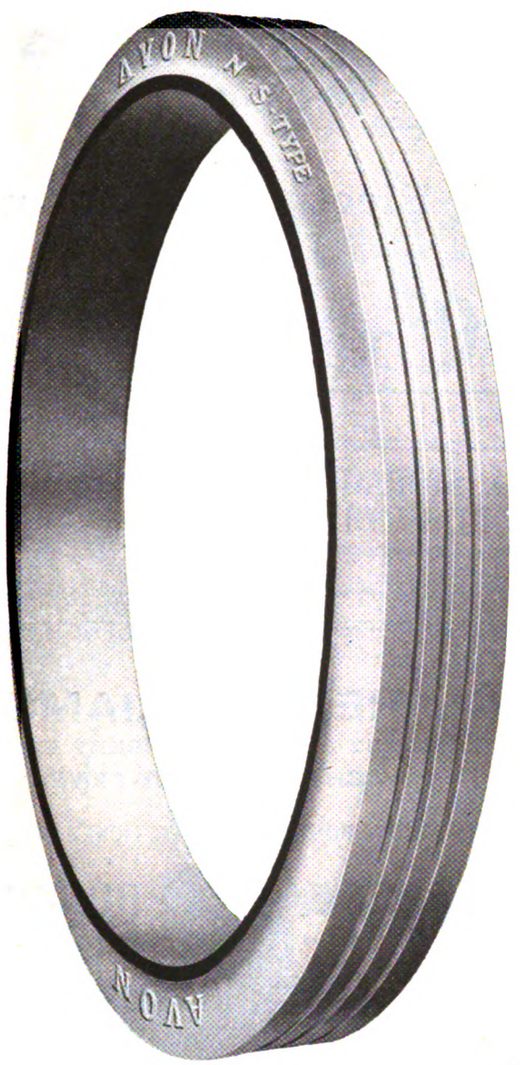

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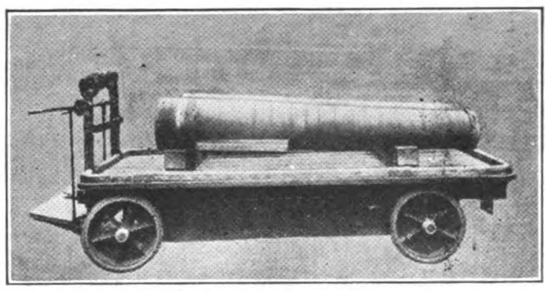

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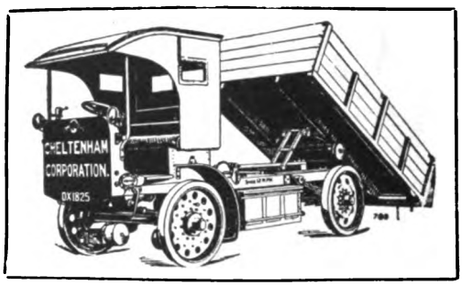

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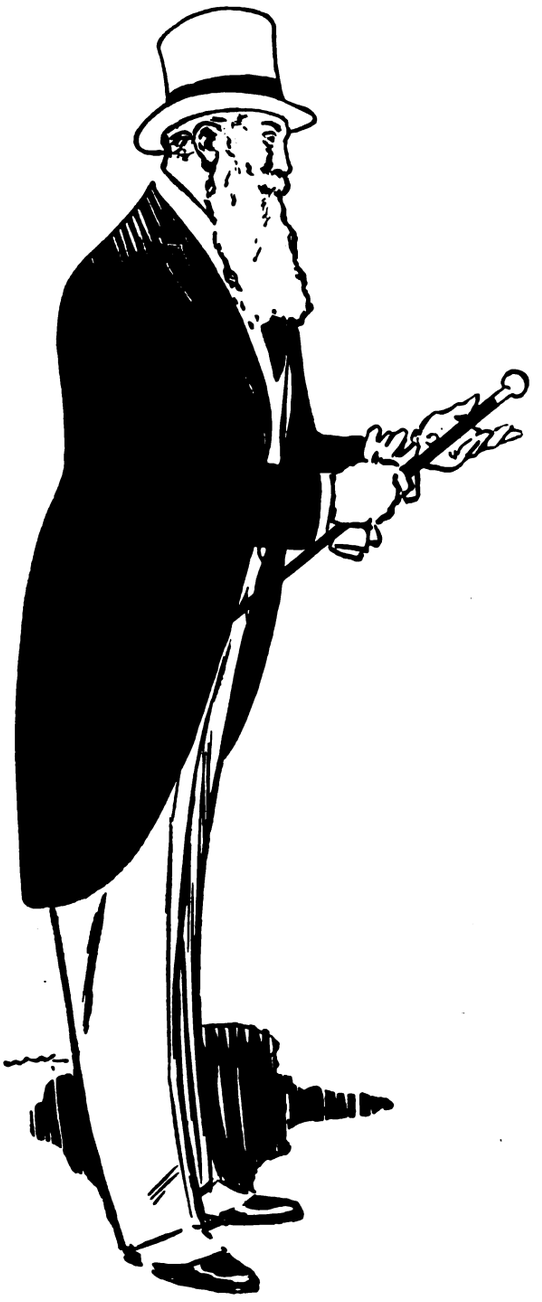

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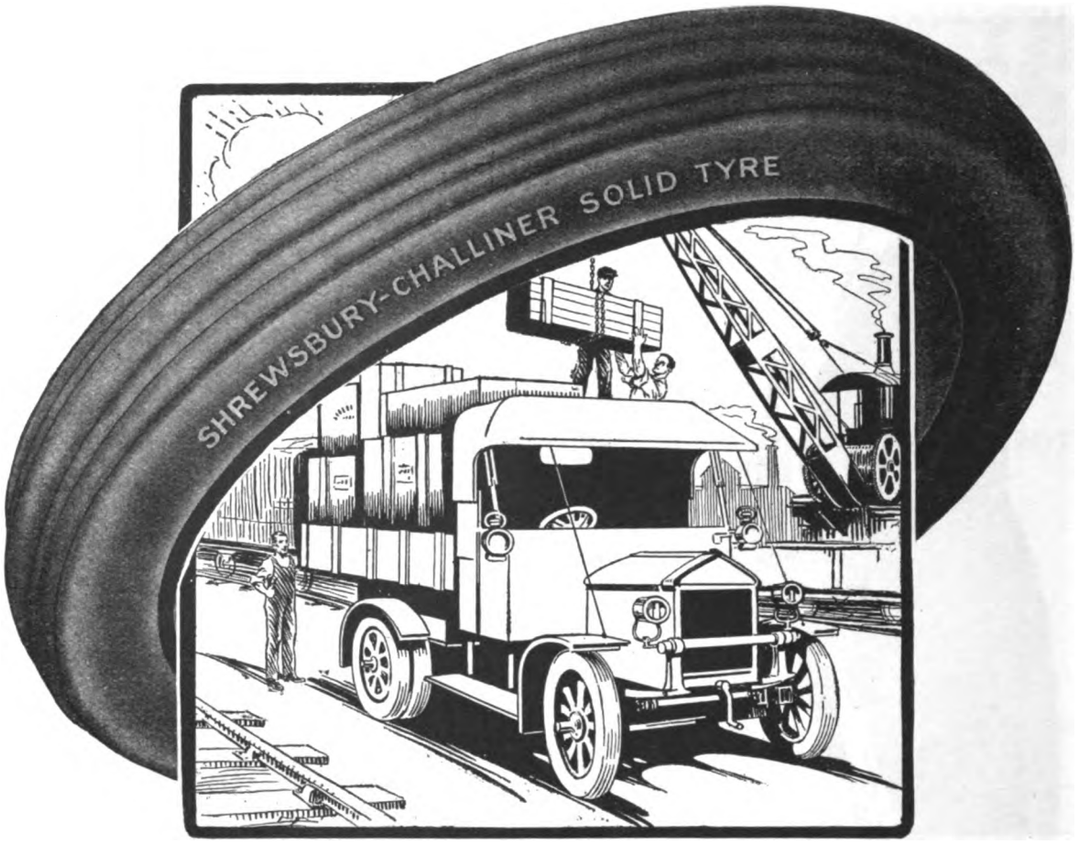

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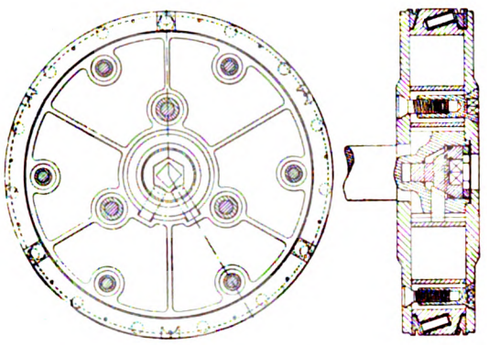

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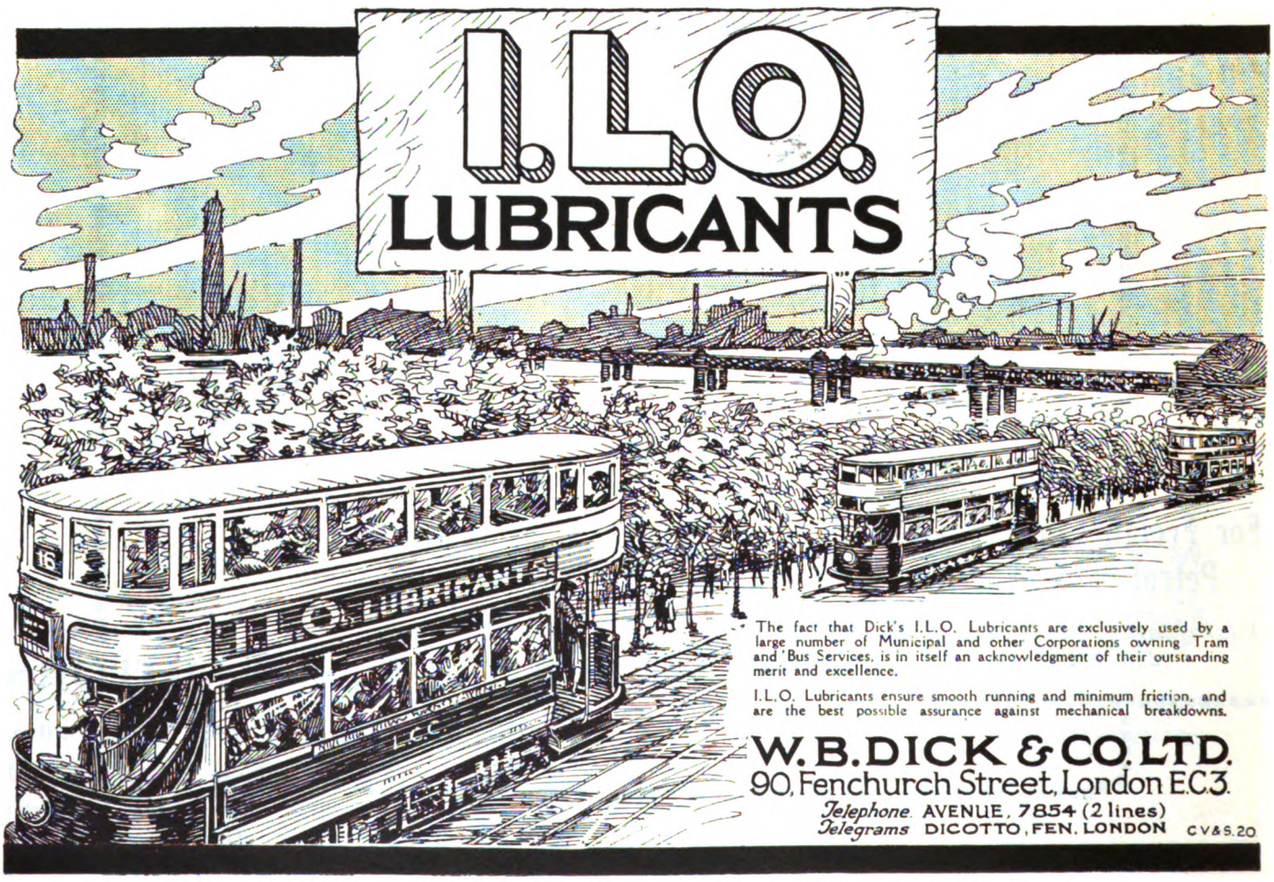

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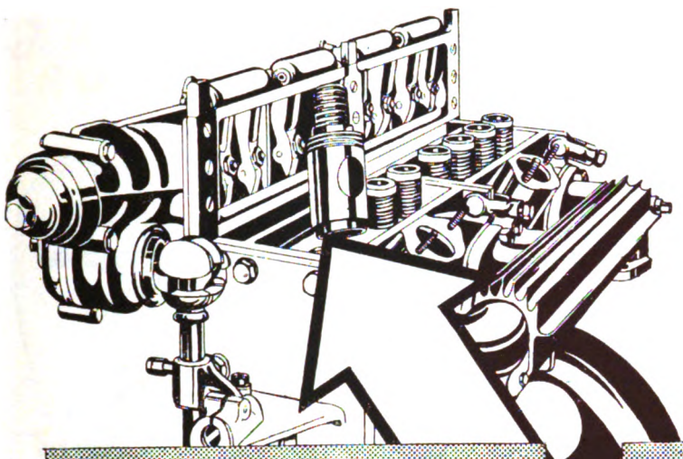

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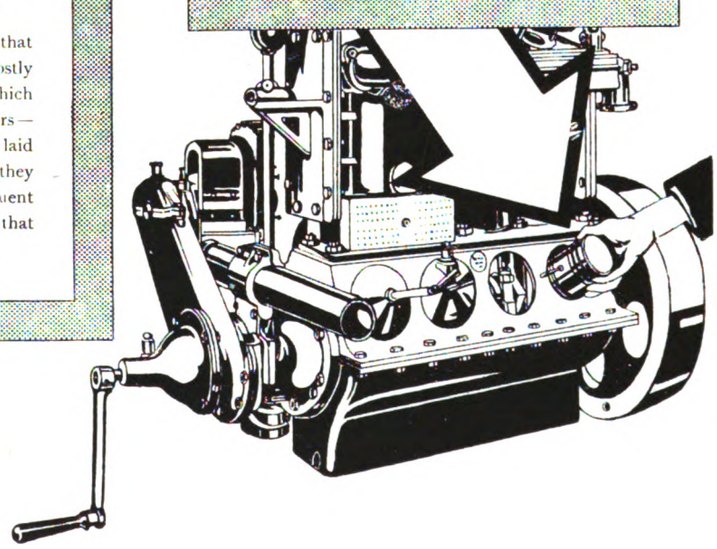

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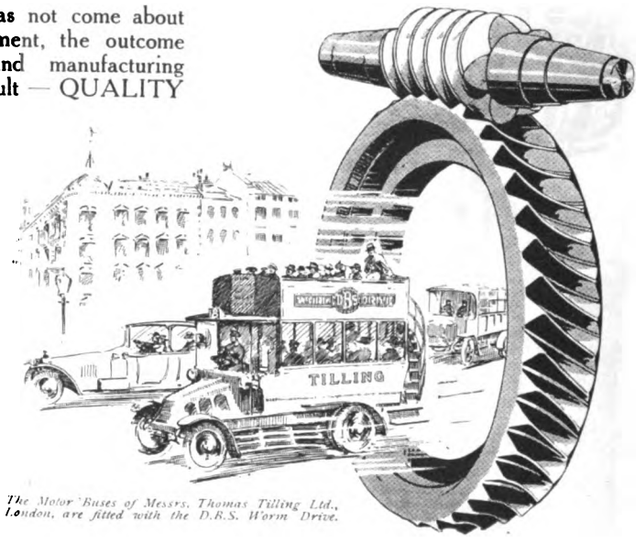

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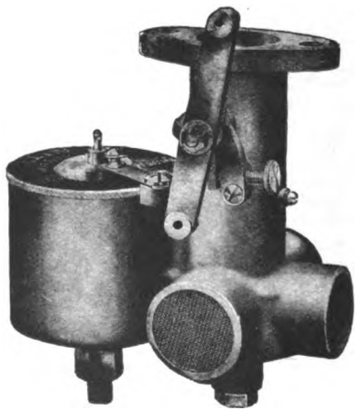

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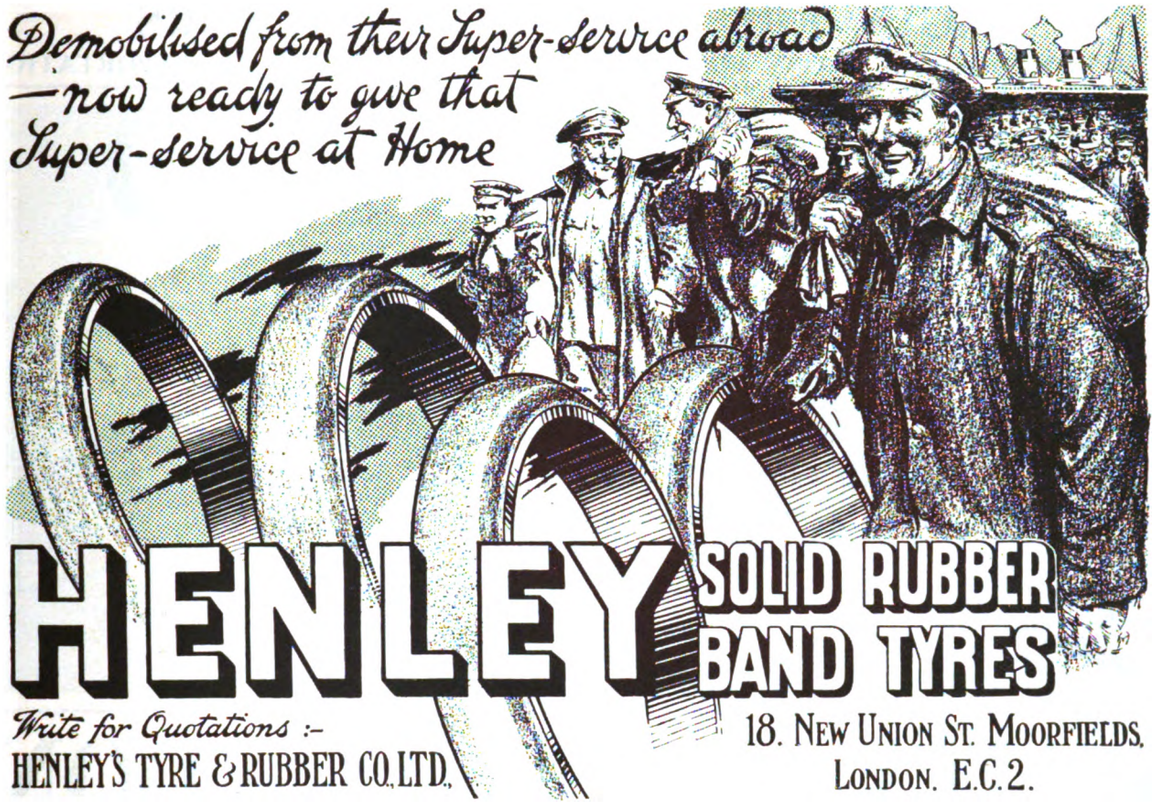

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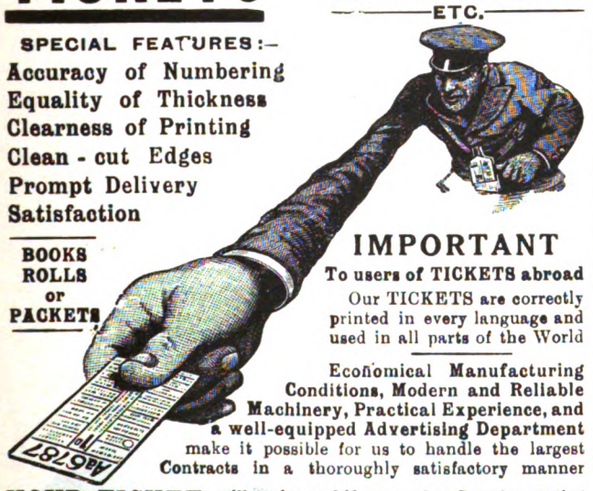

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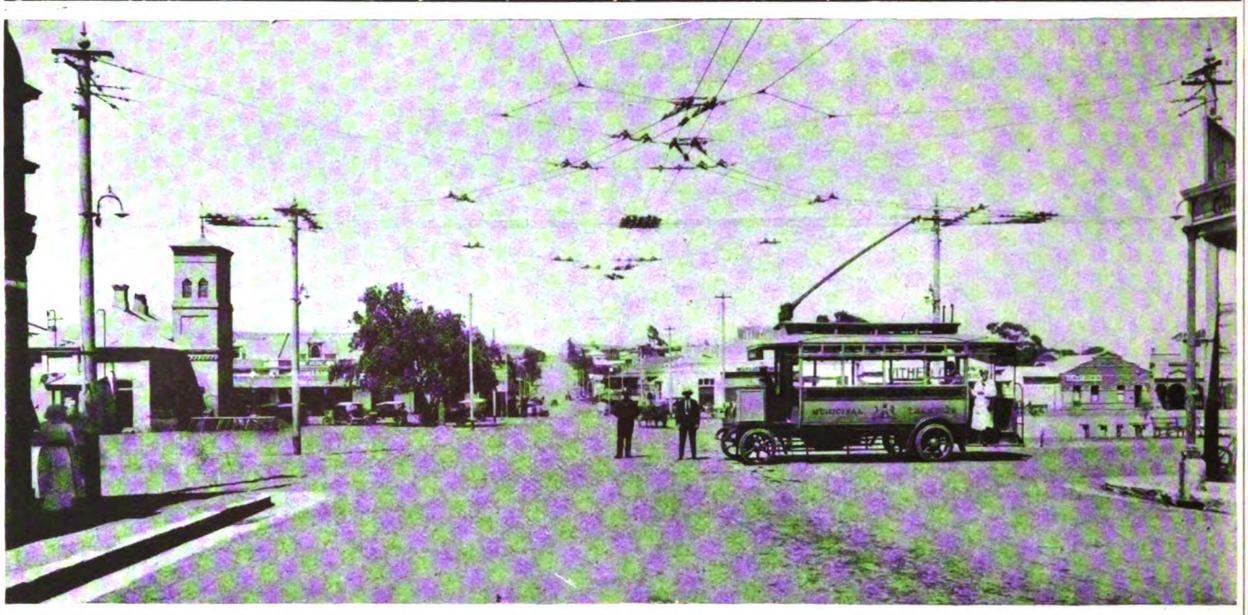

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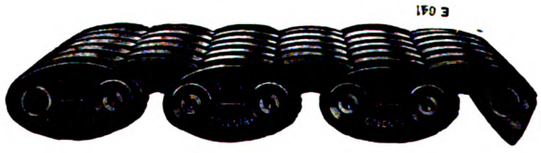

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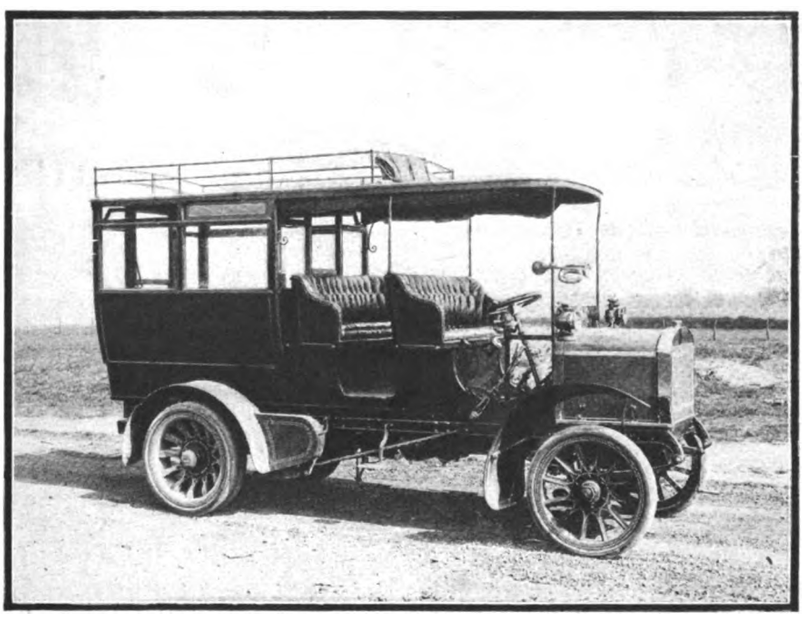

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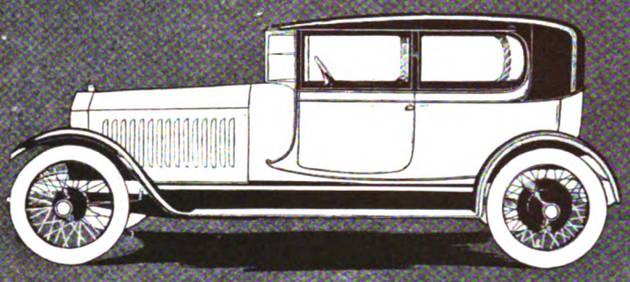

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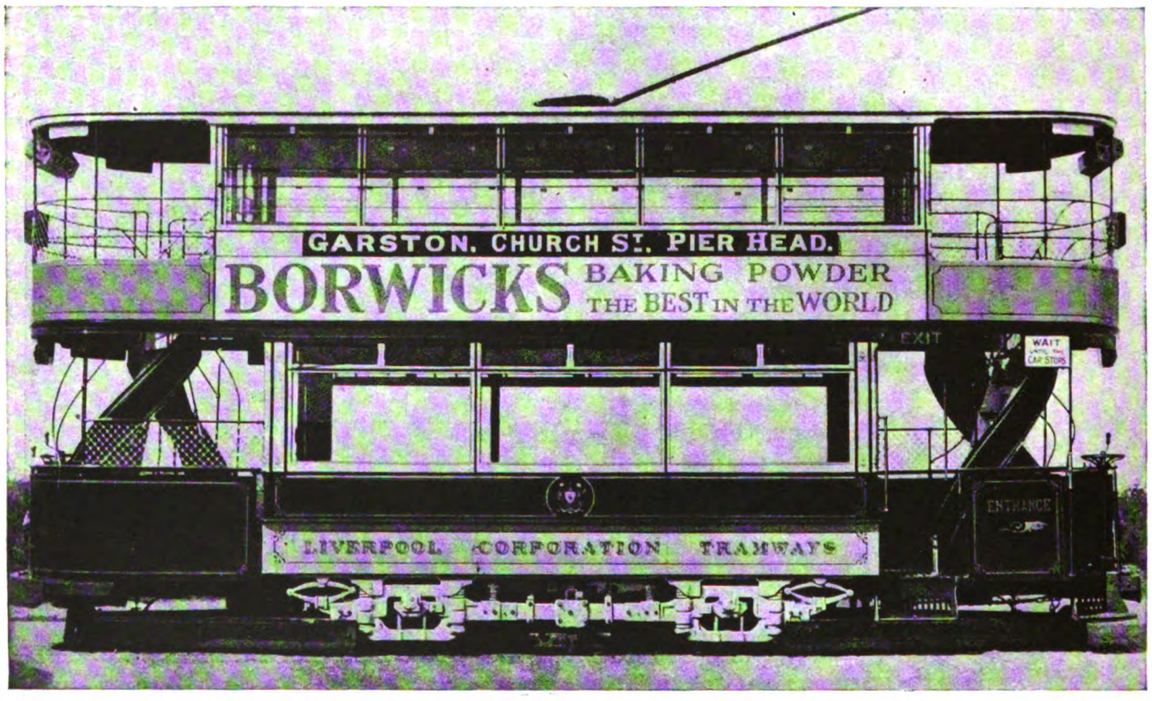

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That is the primary function of tyres. Tyres that will conserve the life and add to the reliability of the chassis. Tyres that possess powers of endurance. Tyres that afford maximum efficiency at minimum cost.

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known as the sturdy Tyres for strenuous service. They are the Tyres to carry you "over the top" to the post war objectives of trade and commercial development.

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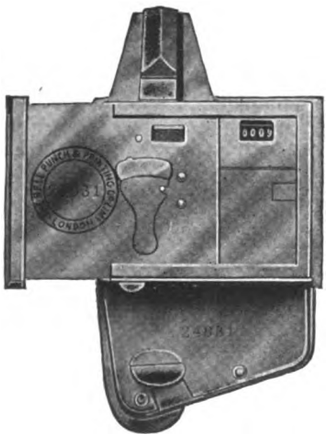

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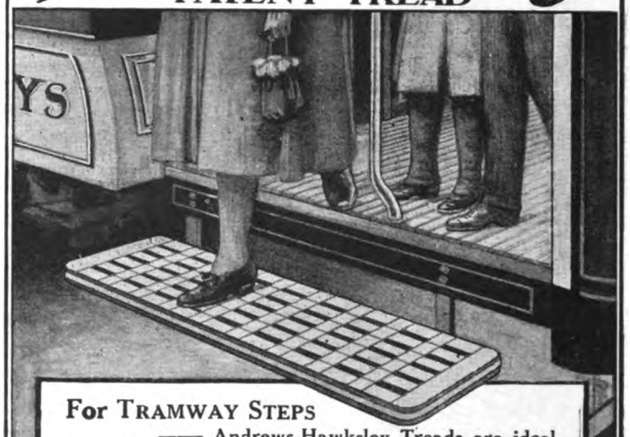

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—— Andrews-Hawksley Treads are ideal.

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We hold testimonials from Tramway Engineers on systems where these Treads are in use, intimating that after more than three years' continuous use they show no signs of wear, *although never reversed*, nor have they ever become slippery even in the wettest weather.

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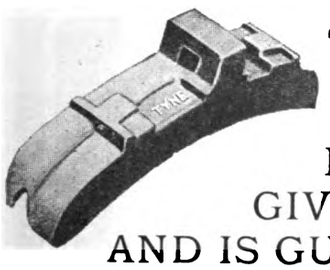

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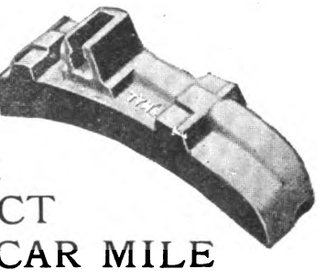

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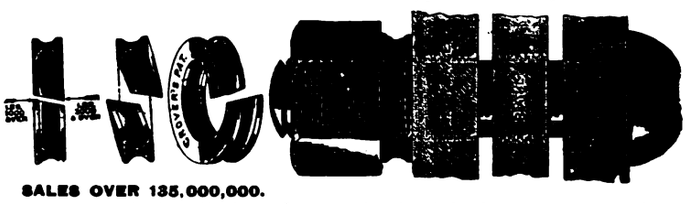

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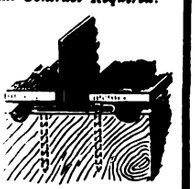

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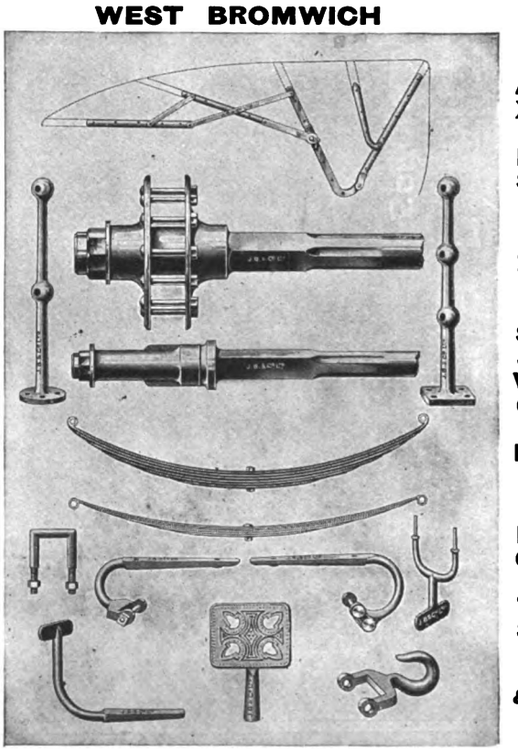

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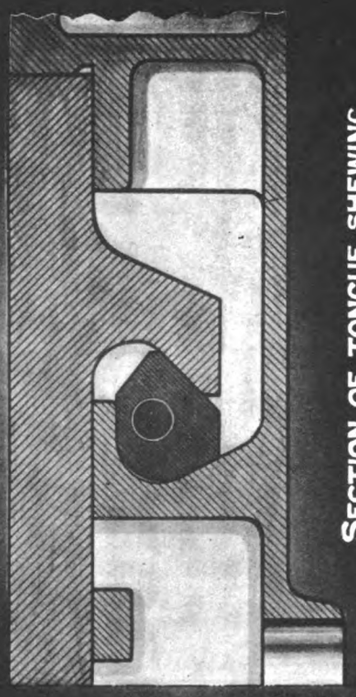

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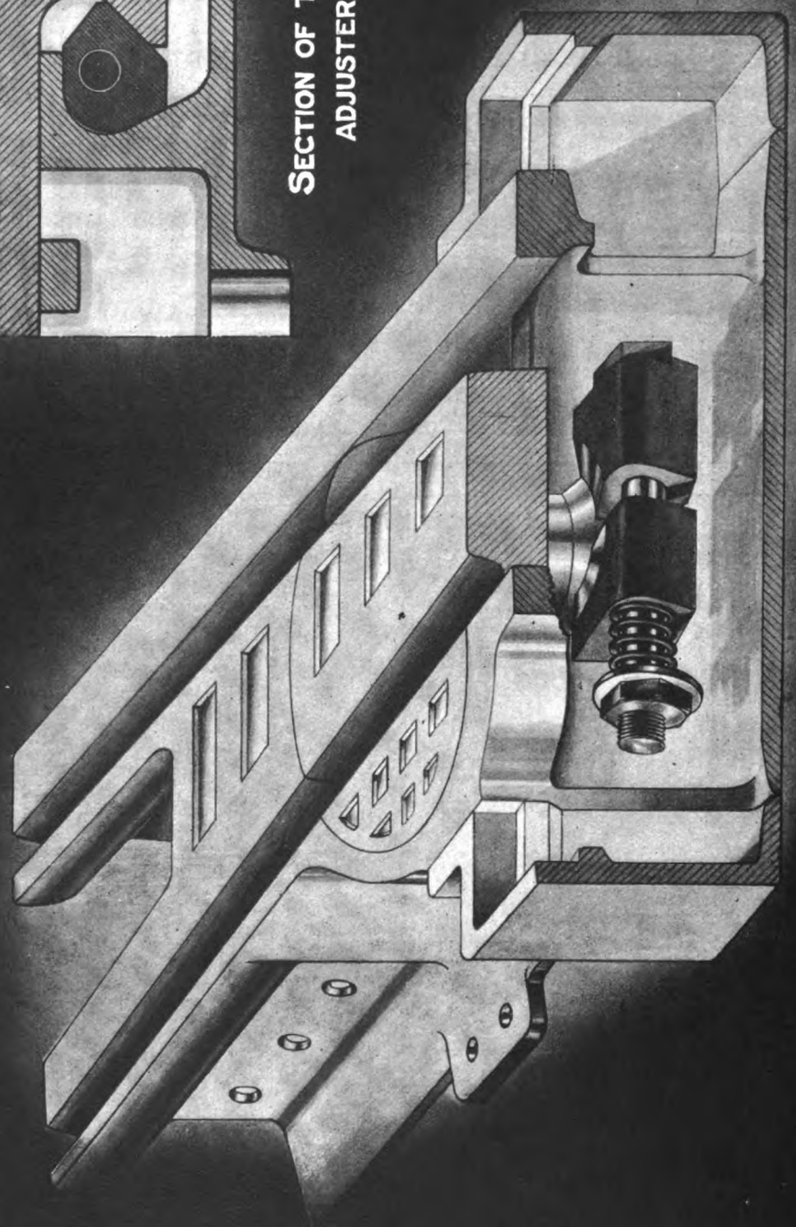

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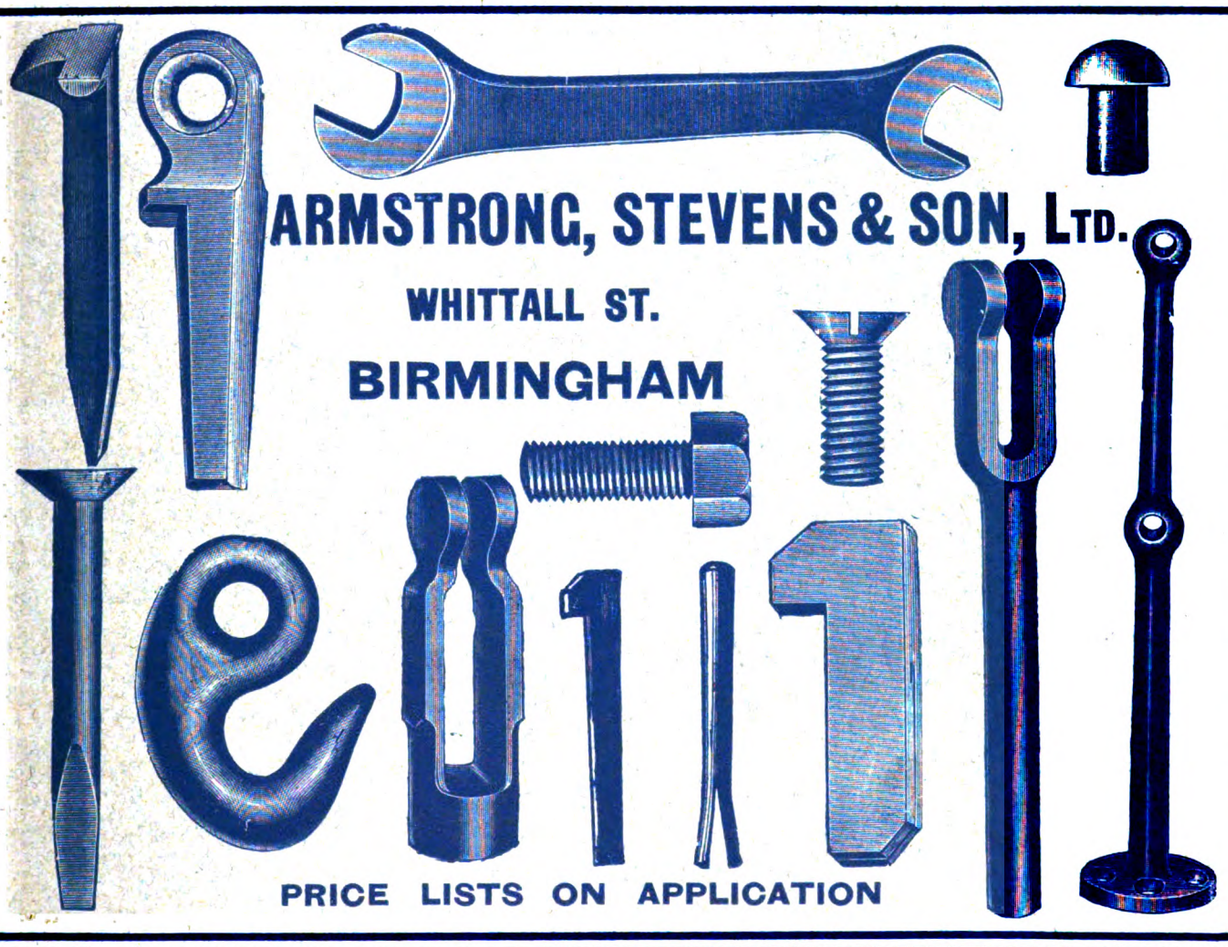

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